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small works in the field of lichenology

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Opuscula Philolichenum is intended to serve as a venue for the publication of small works in the field of lichenology (including lichenicolous fungi and non-lichenized fungi traditionally treated with lichens). The journal is primarily electronic, available on-line free of charge (at http://clade.ansp.org/lendemer/opus.html), with a limited print run to satisfy the requirements for effective publication established under the *International Code for Botanical Nomenclature*.

The central goal of the journal is to provide timely publication, in a professional format, free of charge to authors and readers. While the journal focuses on topics relating to the lichen biota of North America this is by no means exclusive and manuscripts on other topics will be considered as the table of contents of the present issue clearly illustrates.

Authors wishing to submit a manuscript for publication in *Opuscula Philolichenum* should contact the editor prior to submission to confirm that the paper conforms to the mission of the journal (outlined above). Manuscript submissions ***should be left unformatted*** and authors should consult a recent issue of *Opuscula Philolichenum* for style. All submissions are subjected to review by at least two peer reviewers and, following acceptance are formatted by the editor.

As has been noted in the preface to previous issues the backbone of any scientific journal is its cohort of reviewers. As such the editor would like to take this opportunity to thank those who graciously provided peer review of manuscripts published in this volume: Teuvo Ahti, Vagn Alstrup, André Aptroot, Alan Archer, Ulf Arup, Paul Diederich, Robert Dirig, Jack Elix, Damien Ertz, Theodore Esslinger, Alan Fryday, Bernard Goffinet, Gökhan Halici, Richard Harris, David Hawksworth, Brendan Hodkinson, Doug Ladd, Patrick McCarthy, Bruce McCune, Christian Printzen, Robert Lücking, Juan Sanchez, Imke Schmitt, Lucyna Śliwa, Laurens Sparrius, Tor Tønsberg, Dagmar Triebel, Jan Vondrak, and Mikhail Zhurbenko. The editor also extends his sincerest thanks to the associate editors whose efforts in editing and proofing manuscripts, soliciting manuscripts, and corresponding with authors have greatly improved the quality of the journal.

Opuscula Philolichenum

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A synopsis of the lichen genus *Heterodermia* (Physciaceae, lichenized Ascomycota) in eastern North America

James C. Lendemer[1]

ABSTRACT. – A preliminary treatment of the members of the genus *Heterodermia* occurring in eastern North America is provided. A key to species is included with color images of many species that have not been adequately illustrated previously. A new species, *Heterodermia erecta,* is described from high elevations of the southern Appalachians. *Heterodermia microphylla* is provisionally excluded from the study area as all specimens examined were misidentifications of other taxa. A norstictic acid deficient strain of *H. neglecta* is recognized pending further study of the material which may warrant recognition as a distinct species consisting of disjunct populations in the Canadian Maritimes, southern Appalachian Mountains, and central Florida.

Introduction

The roots of this treatment are grounded in nearly five years of field work in the Appalachian Mountains of eastern North America, combined with collecting expeditions throughout the southeastern coastal plain and the Ozarks. Over this time I have collected hundreds specimens of *Heterodermia* Trevis. and visited dozens of localities, with some localities hosting more than half a dozen species. While most specimens were easily identified, problems quickly began to accumulate and consultation of the literature often only resulted in further confusion. Conversations with other lichenologists working in the region made it clear that they had encountered similar problems. This led me to compile a key to the genus *Heterodermia* in eastern North America to aid in the routine identification of specimens. The revision of the material held by The New York Botanical Garden (NY) led to the discovery of significant range extensions (and reductions) as well as the recognition that the taxonomic limits and concepts of some species remained obscure despite the large amount of recent literature on the subject (Dey 1978; Harris 1995; Kurokawa 1962, 1973; Moberg & Nash 2002). Thus, I decided to attempt a preliminary treatment of *Heterodermia* species occurring in eastern North America the results of which are provided here. The present work is not intended to be the final word on the subject, but rather a guide that will both facilitate identification of specimens and highlight areas where taxonomic problems remain. Despite being a genus of charismatic and conspicuous macrolichens, the status of several North American *Heterodermia* species remains unclear. Hopefully this treatment represents a first step toward filling in the gaps in our knowledge.

Materials and Methods

This study is limited primarily to herbarium materials at The New York Botanical Garden (NY). Normally one would prefer to review as much material as possible for such a study, however due to the time and resources required to properly identify specimens it was simply impractical to revise the material held in other large herbaria. *Heterodermia* is an attractive and conspicuous genus, and as such it is frequently collected even by non–lichenologists. An attempt has been made to treat all taxa currently reported from eastern North America. Synonymies are not provided and type specimens are only cited when they are particularly relevant to a problem. Otherwise synonymies and type specimens can be found

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in any number of publications on *Heterodermia* (particularly Kurokawa 1962, and 1998). Similarly, more extensive descriptions can be found in Kurokawa (1962) and Moberg and Nash (2002). All specimens were studied dry using a Bausch & Lomb StereoZoom 7 dissecting microscope and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. Illustrations were prepared using Adobe Photoshop.

Following Kurokawa (1973) I have made an attempt to analyze the terpenoid profiles of each taxon in addition to the other secondary metabolites such as norstictic acid and salazinic acid which are routinely used for identification. A summary of these is provided below (Plate 1). While authors subsequent to Kurokawa (1973) do not appear to have emphasized the presence of terpenoids other than zeorin in most species, these do appear to be species specific in some cases and, as such, could prove particularly useful in future studies. Chromatography was performed using solvents A and C following the standardized methods of Culberson and Kristinsson (1970).

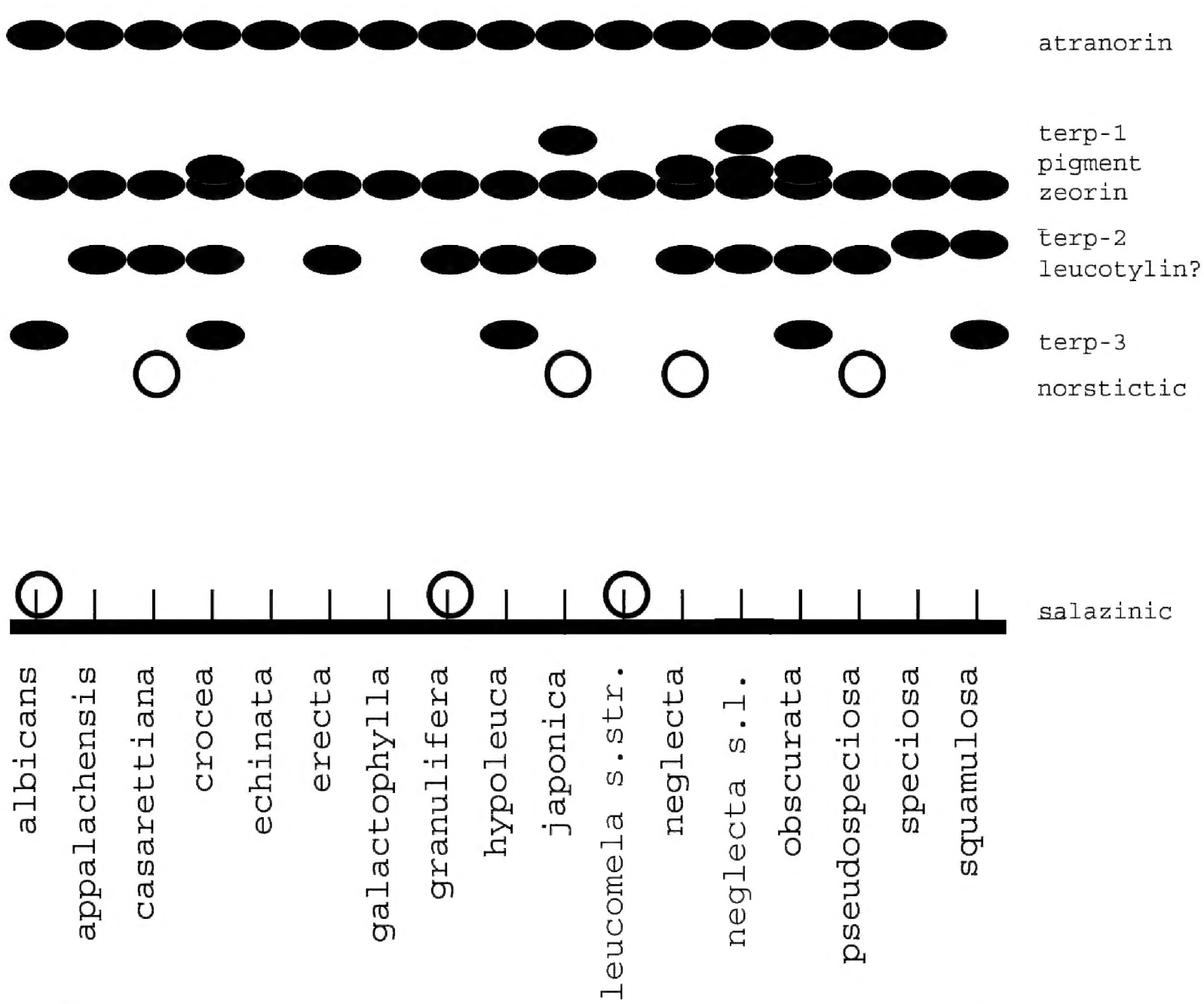

Plate 1. Representative chromatograms of *Heterodermia* species recognized in this treatment run in Solvent C, based on North American material.

Taxonomic Section

I. – Key to Heterodermia in eastern North America

1. Thallus lobes adnate, attached to the substrate, obviously foliose.....2

2. Soredia/isidia/phyllidia absent; apothecia usually present; underside ecorticate, pale....*H. hypoleuca*
2. Soredia/isidia/phyllidia present; apothecia usually absent; underside various.....3

3. Thallus sorediate; soralia marginal or terminal but not laminal.....4

4. Underside ecorticate.....5

5. Underside evenly orange pigmented (pigment K+ purple).....*H. obscurata*
5. Underside not pigmented, **or** pigmented in a manner different than above (e.g. yellow pigmented (pigment K–), purple pigmented, or pigmented only in small patches at the lobe tips).....6

6. Underside with small patches of orange pigment (pigment K+ purple) only at the lobe tips.....7

7. Medulla K+ red, norstictic acid present, terpenoid 1 absent.....*H. neglecta*
7. Medulla K–, norstictic acid absent; terpenoid 1 present.....*H. neglecta* s.l.

6. Underside not pigmented, or pigmented yellow/orange and the pigment K–.....8

8. Underside not pigmented yellow.....9

9. Lobes haphazardly erect, especially in central portions of the thallus; soralia subterminal, not reflexed, not wider than the width of the lobes; montane Appalachians.....*H. erecta*
9. Lobes lying flat and plane; soralia reflexed or not; not montane Appalachians.....10

10. Rhizines thyrsiform[2] and pale; soralia labriform and strongly reflexed, wider than the width of the lobes; terpenoid 1 absent.....*H. galactophylla*
10. Rhizines squarrose and dark; soralia marginal, not as above, not wider than the width of the lobes; terpenoid 1 present.....*H. japonica*

8. Underside pigmented yellow (pigment K–).....11

11. Lobes long and narrow, strap–like (see plate 3); medulla K– (norstictic acid absent); rare.....*H. appalachensis*
11. Lobes not as above (see plate 4); medulla K+ red (norstictic acid present) or K–.....12

12. Pigment confined to the lobe tips; coastal plain....*H. japonica* s. lat.
12. Pigment central and spreading towards thallus margins, but not confined to the lobe tips; Appalachian/Piedmont....*H. casarettiana*

4. Underside corticate.....13

13. Medulla K– (salazinic acid absent).....*H. speciosa*
13. Medulla K+ yellow turning red.....14

14. Medulla with salazinic acid; thallus large; common and usually corticolous; coastal plain/piedmont.....*H. albicans*

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[2] thyrsiform – Throughout this treatment the term is used following Kurokawa (1962) to denote a rhizine in which the branching resembles the type of inflorescence referred to as a thryse in vascular plants. See plate 7, figure 2, herein.

14. Medulla with norstictic acid; thallus small; rare and usually saxicolous; Appalachians..... *H. pseudospeciosa*

3. Thallus with laminal isidia/isidioid–soredia or with minute marginal phyllidia/lobules.....15

15. Thallus with minute marginal phyllidia/lobules..... *H. squamulosa*
15. Thallus with laminal isidia/isidioid–soredia.....16

16. Underside pigmented orange (pigment K+ purple); medulla K– (salazinic acid absent); SE..... *H. crocea*
16. Underside not pigmented orange; medulla K+ red (salazinic acid present); mostly northern/central..... *H. granulifera*

1. Thallus lobes not adnate, often ascending; appearing fruticose.....17

17. Soredia absent; apothecia usually present..... *H. echinata*
17. Soredia present; lobes strap–like.....18

18. Underside irregularly yellow pigmented; medulla without salazinic acid; rare..... *H. appalachensis*
18. Underside not pigmented yellow; medulla with or without salazinic acid; common.....19

19. Marginal cilia red pigmented (pigment an anthraquinone, K+ purple); medulla K– (salazinic acid lacking)..... *H.* cf. *leucomela*
19. Marginal cilia not red pigmented; medulla K+ red (salazinic acid or norstictic acid).....20

20. Medulla with salazinic acid; Appalachian..... *H. leucomela* s. str.
20. Medulla with norstictic acid; Florida..... *H. leucomela* s.l.

II. – The Species

1. *Heterodermia albicans* (Pers.) Swinscow & Krog

Plate 2 (page 7).

Description. – **Thallus** foliose, sorediate, **upper surface** gray to blue–gray; **lobes** long, plane, epruinose, marginally spreading and flat, centrally overlapping; **medulla** white; **underside** corticate, pale to light brown at centrally; **rhizines** pale, simple, primarily marginal; **soralia** marginal and becoming laminal in central portions of the thallus, often coalescing; **soredia** very fine and often powdery; **apothecia** infrequent, laminal, often in the central portions of the thallus, with sorediate margins.

Chemistry. – Atranorin, zeorin, terpenoid 3, salazinic acid. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K+ yellow turning red, C–, KC–, P+ yellow–orange, UV–.

Ecology and distribution. – This species is common and widespread on the bark of hardwoods and occasionally on rock in southeastern North America and the Ozark Ecoregion.

Discussion. – *Heterodermia albicans* is common in southeastern North America, where it is easily recognized by its corticate lower surface and K+ red (salazinic acid) medulla. Generally speaking the thallus is more apressed than that of *H. speciosa*, which is rarer in southeastern North America.

Selected Specimens Examined. – **U.S.A. ALABAMA**. BALDWIN CO.: Fairhope, 17.x.1924, *A.W. Evans 32* (NY). CLAY CO.: Talladega National Forest, 24.ix.1992, *R.C. Harris 28374* (NY). JACKSON CO.: Buck's Pocket State Park, 3.x.1998, *R.C. Harris 42409* (NY). MASHALL CO.: Lake Guntersville State Park, 13.viii.2005, *J.C. Lendemer 4868* (NY). MONROE CO.: Haines Island Park, 31.vii.2003, *W.R. Buck 44878* (NY). **ARKANSAS**. CRAWFORD CO.: Ozark National Forest, Natural Dam, 15.iv.2004, *R.C. Harris 49114* (NY). JEFFERSON CO.: Pine Bluff Arsenal, 2.xii.1999, *D. Ladd 21992* (NY). LAWRENCE CO.: Shirey Bay – Rainey Brake Wildlife Management Area, 29.iii. 2006, *J.C. Lendemer et al. 6693* (NY). MARION CO.: Jones Point Wildlife Management Area, 16.iv.2005, *R.C. Harris 50944* (NY). POPE CO.: Ozark National Forest, Cowan Hollow, 7.xi.2002, *R.C. Harris 46941* (NY). PULASKI

CO.: Little Rock Air Force Base, 29.iii.1997, *D. Ladd 20031* (NY). RANDOLPH CO.: Robert L. Haskins/Mud Creek Wildlife Management Area, 17.x.2003, *R.C. Harris 48666* (NY). SHARP CO.: Strawberry River Preserve, 25.x.2001, *R.C. Harris 45566* (NY). **FLORIDA**. ALACHUA CO.: Paynes Prairie State Preserve, 1.xii.1992, *R.C. Harris 29459–A* (NY). BAKER CO.: Along CR 127 at Moccasin Creek, 26.xi.1996, *R.C. Harris 39318* (NY). BAY CO.: N of Fla. Hwy. 20, 1.xii.1994, *R.C. Harris 35743* (NY). BRADFORD CO.: Along Co. Rd. 235, 3.xii.1994, *R.C. Harris 35906* (NY). CITRUS CO.: St. Martins Marsh Aquatic Preserve, 5.xiii.1996, *R.C. Harris 39774* (NY). COLUMBIA CO.: Ichetucknee Springs State Park, 2.xii.1992, *R.C. Harris 29572* (NY). DIXIE CO.: Big Bend Wildlife Management Area, 4.xii.1996, *R.C. Harris 39579* (NY). DUVAL CO.: Big Talbot Island State Park, 17.xii.1988, *R.C. Harris 23883* (NY). FRANKLIN CO.: Little St. George Island, 25–26.v.2002, *R. Yahr 4440a* (NY). HAMILTON CO.: Holton Creek Wildlife Management Area, 14.xii.1993, *R.C. Harris 32431* (NY). HIGHLANDS CO.: Hickory Hammock, 28.iii.1998, *R.C. Harris 41942* (NY). LEE CO.: Caloosahatchee River State Recreation Area, 10.xii.1992, *W.R. Buck 23004* (NY). MADISON CO.: 0.3 mi on dirt road W of Co. Rd. 150, 14.xii.1993, *R.C. Harris 32370* (NY). MANATEE CO.: Upper Myakka River Watershed, 29.iii.1998, *R.C. Harris 42023* (NY). NASSAU CO.: Fort Clinch State Park, 16.xii.1987, *R.C. Harris 21141* (NY). OKEECHOBEE CO.: Viking Property, 29.iii.1998, *R.C. Harris 41902* (NY). OSCEOLA CO.: Bull Creek Wildlife Management Area, 9.i.1996, *R.C. Harris 37581* (NY). POLK CO.: Nalcrest, 15.vi.1988, *E.M. Wheeler s.n.* (NY). SARASOTA CO.: Myakka River State Park, 5.xii.1992, *R.C. Harris 29849–A* (NY). SEMINOLE CO.: Little Big Econlockhatchee State Forest, 10.i.1996, *R.C. Harris 37655* (NY). ST. JOHNS CO.: Guana Rivers State Park, 24.xii.1995, *R.C. Harris 37048* (NY). SUMTER CO.: Croom–a–coche, 28.xi.1982, *C.F. Reed 116847* (NY). SUWANNEE CO.: Peacock Springs State Park, 2.xii.1996, *R.C. Harris 39369* (NY). TAYLOR CO.: Big Bend Wildlife Management Area, 3.xii.1996, *R.C. Harris 39521* (NY). UNION CO.: Lake Butler Wildlife Management Area, 4.xii.1994, *R.C. Harris 36021* (NY). VOLUSIA CO.: Turtle–Mound, 1.iv.1921, *J.K. Small 10355–D* (NY). **GEORGIA**. CLARKE CO.: East Athens, 2.x.1992, *R.C. Harris 28942* (NY). COFFEE CO.: Broxton Rocks Ecological Preserve, 4.ii.1995, *R.C. Harris 36148* (NY). COLUMBIA CO.: Heggies Rock Preserve, 6.x.1999, *W.R. Buck 36500* (NY). WILKINSON CO.: along US 441, 2.2. mi S of Commissioner Creek, 19.ix.1996, *R.C. Harris 38844* (NY). **KENTUCKY**. NELSON CO.: Rte. 31E, Bardstown, 13.xi.1980, *C.F. Reed 112132* (NY). **LOUISIANA**. CALCASIEU PARISH.: Lake Charles, 3.viii.1960, *R.A. Pursell 4420 & W.D. Reese* (NY). CONCORDIA PARISH.: 9 mi W of Ferriday, 25.i.1955, *L.F. Koch 9237* (NY). EAST BATON ROUGE PARISH.: Burden Research Plantation, 31.v.1975, *S.C. Tucker 14101* (NY). EAST FELICIANA PARISH.: Idlewild Experimental Farm, 16.iii.1979, *S.C. Tucker 18420* (NY). ORLEANS PARISH.: Algiers, 21.ii.1982, *J. Pruski 2336* (NY). ST. JAMES PARISH.: Frenicr, 8.viii.1954, *L.F. Koch 7077* (NY). ST. MARIN PARISH.: St. Martinsville, 15.ii.1893, *A.B. Langlois 134* (NY). ST. TAMMANY PARISH.: Fontainbleau State Park, 7.iii.1982, *J. Pruski 2414* (NY). TANGIPAHOA PARISH.: Amite, 7.iii.1982, *J. Pruski 2380* (NY). **MISSISSIPPI**. HINDS CO.: 3 mi N of Terry, 11.vi.1939, *G.T. Johnson 2376 & H.N. Andrews* (NY). JASPER CO.: Bienville National Forest, 30.ix.1992, *R.C. Harris 28844–B* (NY). ITAWAMBA CO.: Donivan Slough, 28.ix.1992, *R.C. Harris 28627* (NY). SCOTT CO.: Bienville National Forest, 29.ix.1992, *R.C. Harris 28723* (NY). SHARKEY CO.: Delta National Forest, vii.1978, *G.T. Johnson s.n.* (NY). SMITH CO.: Bienville National Forest, 30.ix.1992, *R.C. Harris 28795* (NY). WILKINSON CO.: Clark Creek Natural Area, 6.iv.1982, *J. Pruski 2558* (NY). WINSTON CO.: Tombigbee National Forest, 28.ix.1992, *R.C. Harris 28698* (NY). **MISSOURI**. AUDRAIN CO.: Marshall I. Diggs Conservation Area, 13.iv.2005, *R.C. Harris 50617* (NY). BOLLINGER CO.: Castor River Conservation Area, 22.x.2001, *R.C. Harris 45160* (NY). BUTLER CO.: Poplar Bluff Conservation Area, 23.x.2001, *R.C. Harris 45219* (NY). CAPE GIRARDEAU CO.: Apple Creek Conservation Area, 13.x.2003, *R.C. Harris 48229* (NY). WAYNE CO.: Sam A. Baker State Park, 15.x.2003, *R.C. Harris 48441* (NY). **NORTH CAROLINA**. BLADEN CO.: N of Elwell Ferry Road, 15.vi.2002, *R.C. Harris 46077* (NY). CURRITUCK CO.: N of Mamie, 3.iv.1964, *C.F. Reed 66177–B* (NY). DARE CO.: Roanoke Island, 29.ix.1993, *R.C. Harris 31062* (NY). HENDERSON CO.: Pisgah National Forest, 30.iv.2006, *R.C. Harris 52575* (NY). PITT CO.: East Carolina University Campus, 21.xi.1981, *C.F. Reed 113141* (NY). TRANSYLVANIA CO.: Gorges State Park, 12.viii.2005, *J.C. Lendemer 4777 & E. Tripp* (NY). **OKLAHOMA**. ADAIR CO.: just NE of Stilwell City Lake, 1.xi.2000, *R.C. Harris 44508* (NY). SEQUOYAH CO.: Sallisaw–Brushy Lake State Park, 1.xi.2000, *R.C. Harris 44551* (NY). **SOUTH CAROLINA**. LEXINGTON CO.: Peachtree Rock Nature Preserve, 13.iii.1997, *R.C. Harris 39926* (NY). **VIRGINIA**. WILLIAMSBURG CITY.: College of William and Mary, 22.vii..2004, *B.P. Hodkinson 1107* (NY).

2. *Heterodermia appalachensis* (Kurok.) Culb.

Plate 3 (page 8).

Description. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray, often ashy–white; **lobes** long, strap–like, plane, epruinose, marginally and centrally spreading and flat, overlapping with the secondary lobes reflexed to reveal the soralia; **medulla** white with patches of yellow pigment; **underside** ecorticate, white with large patches of yellow pigment; **pigment** pale to lemon yellow, K–; **rhizines** marginal and terminal, pale above and darkening below, simple; **soralia** sub–terminal, on the lower surface of the lobes; **soredia** fine, granular; **apothecia** not seen.

CHEMISTRY. – Atranorin, zeorin, leucotylin?, pigment. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

ECOLOGY AND DISTRIBUTION. – *Heterodermia appalachensis* is a rare species restricted to the bark of hardwoods in the Appalachian Mountains of eastern North America.

DISCUSSION. – Since its description in the 1960's this species, distributed in the southern Appalachian Mountains, seems to have been collected with increasing rarity. This may represent a decline in collection efforts in the southern Appalachians, or a decline of the species itself. As discussed by Brodo et al. (2001), the species is similar to *H. leucomela* but differs in having a yellow pigmented lower surface and lacking salazinic acid. Based on the specimens examined, *H. appalachensis* is also generally larger than *H. leucomela* and has broader lobes. It is interesting to note that *H. appalachensis* differs from other members of the *H. leucomela* group in having terminal soralia rather than soralia on the underside of the lobes, back from the lobe tips.

SELECTED SPECIMENS EXAMINED. – **U.S.A. ALABAMA**. CLEBURNE CO.: Mt. Cheaha State Park, 6.v.2004, *S.Q. Beeching 141* (hb. Beeching). **NORTH CAROLINA**. ALLEGHANY CO.: N of Sparta, 13.vi.1964, *C.F. Reed 138181* (NY!). AVERY CO.: near Ingalls, vi.1956, *W.L. Culberson 12297* (DUKE). CLAY CO.: Nantahala National Forest, ~3 mi N of Tate City, 17.ix.2006, *J.C. Lendemer et al. 7706* (PH!). HENDERSON CO.: Pisgah National Forest, 30.iv. 2006, *W.R. Buck 50182* (NY!). JACKSON CO.: Cedar Cliff Mountain, 11.viii.1994, *R.C. Harris 33041* (NY!). MADISON CO.: sine loc., 17.vi.1993, *F.H.M.G. 3508284–8* (DUKE). STOKES CO.: 12 mi NE of Pinnacle, 31.vii. 1957, *W.L. Culberson 6334* (DUKE). TRANSYLVANIA CO.: 4.5 mi W of Rosman, viii.1956, *W.L. Culberson 5428* (DUKE). WILKES CO.: Stone Mountain State Park, 23.ix.1993, *R.C. Harris 30809* (NY!). **TEXAS**. BREWSTER CO.: Big Bend National Park, 14.v.2002, *C.M. Wetmore 87798* (PH!). **VIRGINIA**. DICKENSON CO.: Big Ridge, 16.vi.1964, *C.F. Reed 66874* (NY!). GILES CO.: Mountain Lake, viii.1963, *W.L. Culberson 11404* (DUKE). **WEST VIRGINIA**. PENDLETON CO.: 6 mi W of Sugar Grove, 19.vii.1967, *C.F. Reed 75688* (NY!). POCAHONTAS CO.: Monongahela National Forest, vicinity of Devil's Garden, 21.x.2007, *J.C. Lendemer 9854* (NY!).

3. *Heterodermia barbifera* (Nyl.) K.P. Singh

DISCUSSION. – Before explaining how this name came to arrive on the North American checklist (Esslinger 2008) it should be noted that the species may be identical to *H. podocarpa* (Bél.) Awasthi. The only differences cited by Kurokawa (1962) to separate the species are the characters of the upper surface (smooth vs. verruculose) and whether the rhizines form a mat along the margins of the lobes.

Both names presently appear on the North American checklist (Esslinger 2008) based on Harris (1990) and Kurokawa (1962) respectively. The first report of *Heterodermia barbifera* from North America was made by Harris (1990) who based his report on a specimen from Hillsborough County, Florida, cited by Kurokawa (1962) as *H. podocarpa*. The reason Harris (1990) used the name *H. barbifera* instead of *H. podocarpa* was that in a personal communication André Aptroot had noted that he considered the taxa to be distinct, with *H. podocarpa* being endemic to Asia. Unfortunately Aptroot never published the reasoning for this conclusion (in the citation of Aptroot (1987) by Schumm (2001) only *H. barbifera* is discussed). If indeed *H. podocarpa* were considered an Asian endemic, then the correct name for the neotropical material would be *H. barbifera*. Regardless of the taxonomic status of *H. barbifera* and *H. podocarpa*, the North American material is referable to a single taxon, the oldest name for which is *H. podocarpa*. Until the status of *H. barbifera* is sufficiently clarified the name should be removed from the North American checklist. The report by Harris (1990) should be considered a misidentification of *H. podocarpa* since that is the only name that has actually been reported from North America (Kurokawa 1962, Moberg & Nash 2004). I have not been able to review the specimen cited by Kurokawa (1962) and as such the taxon is not included in the key. In the present treatment this species would key to *H. echinata*, from which it differs in its smaller size, more ciliate margins, and the presence of norstictic acid in the medulla.

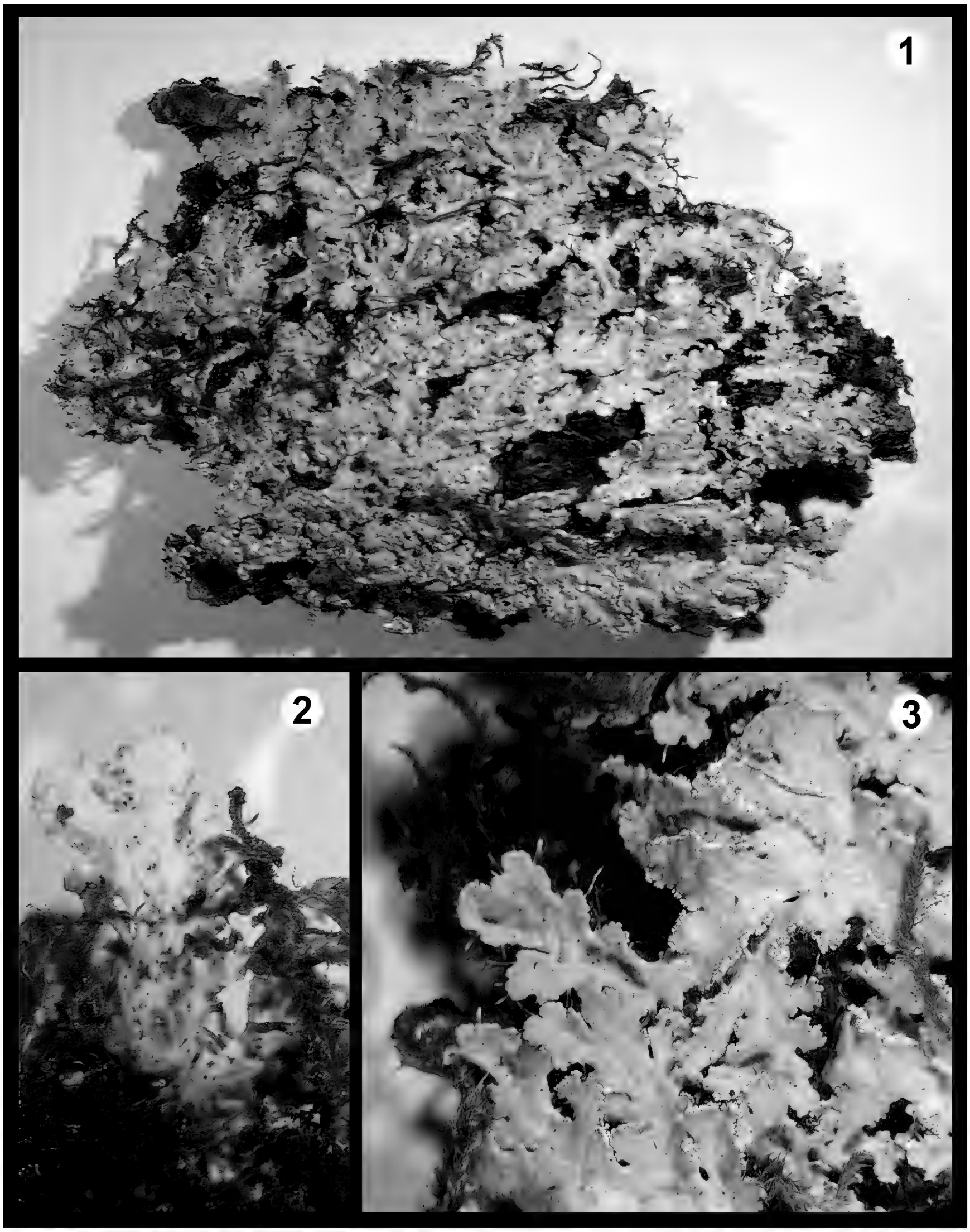

Plate 2. *Heterodermia albicans* (all Buck 44878, NY). Figure 1, thallus. Figure 2, underside of lobe showing corticate lower surface. Figure 3, marginal soralia.

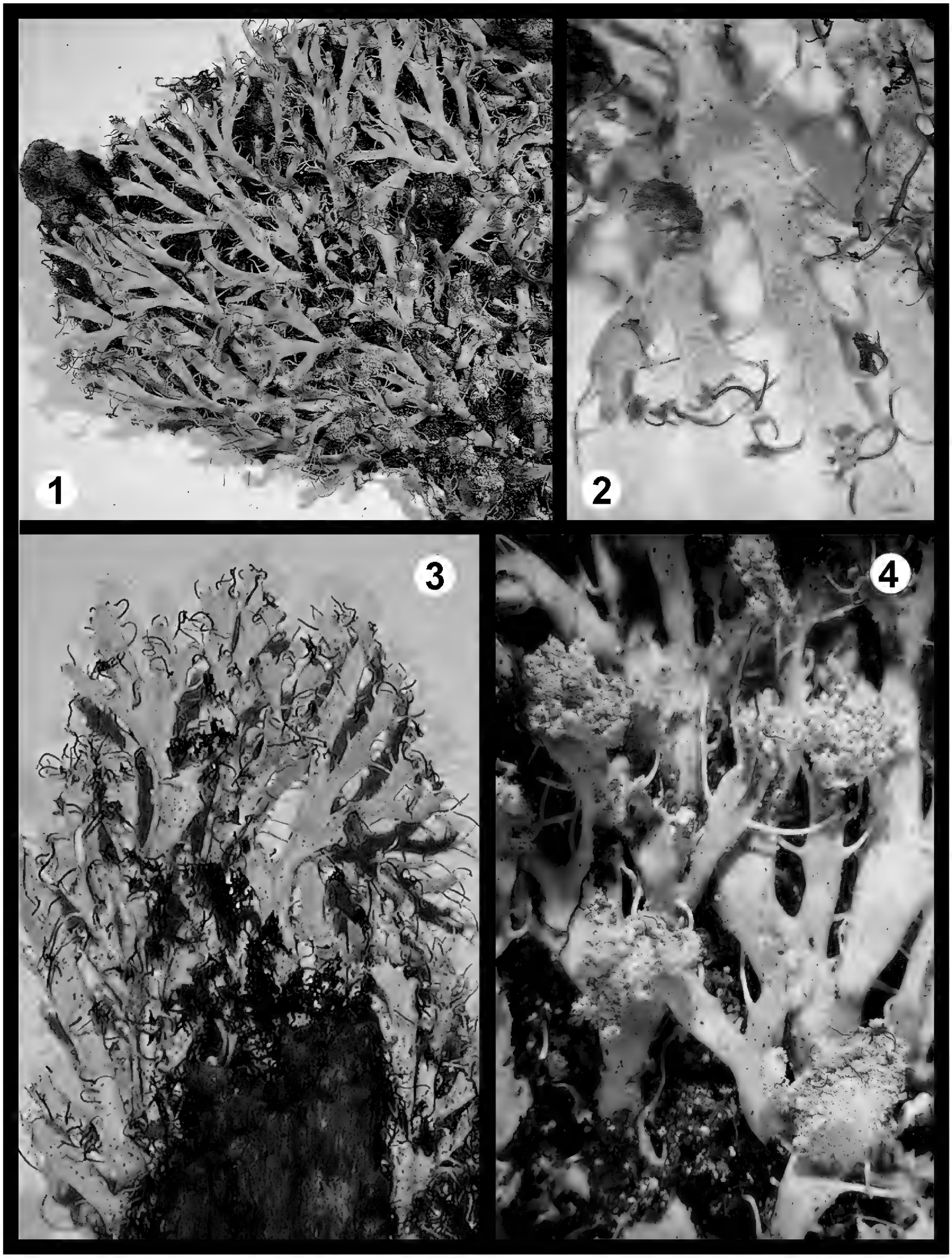

Plate 3. *Heterodermia appalachensis* (all Lendemer 9854, NY). Figure 1, thallus. Figure 2, detail of underside of a lobe, illustrating patches of pigment and rhizines. Figure 3, underside. Figure 4, detail of soralia, view from above.

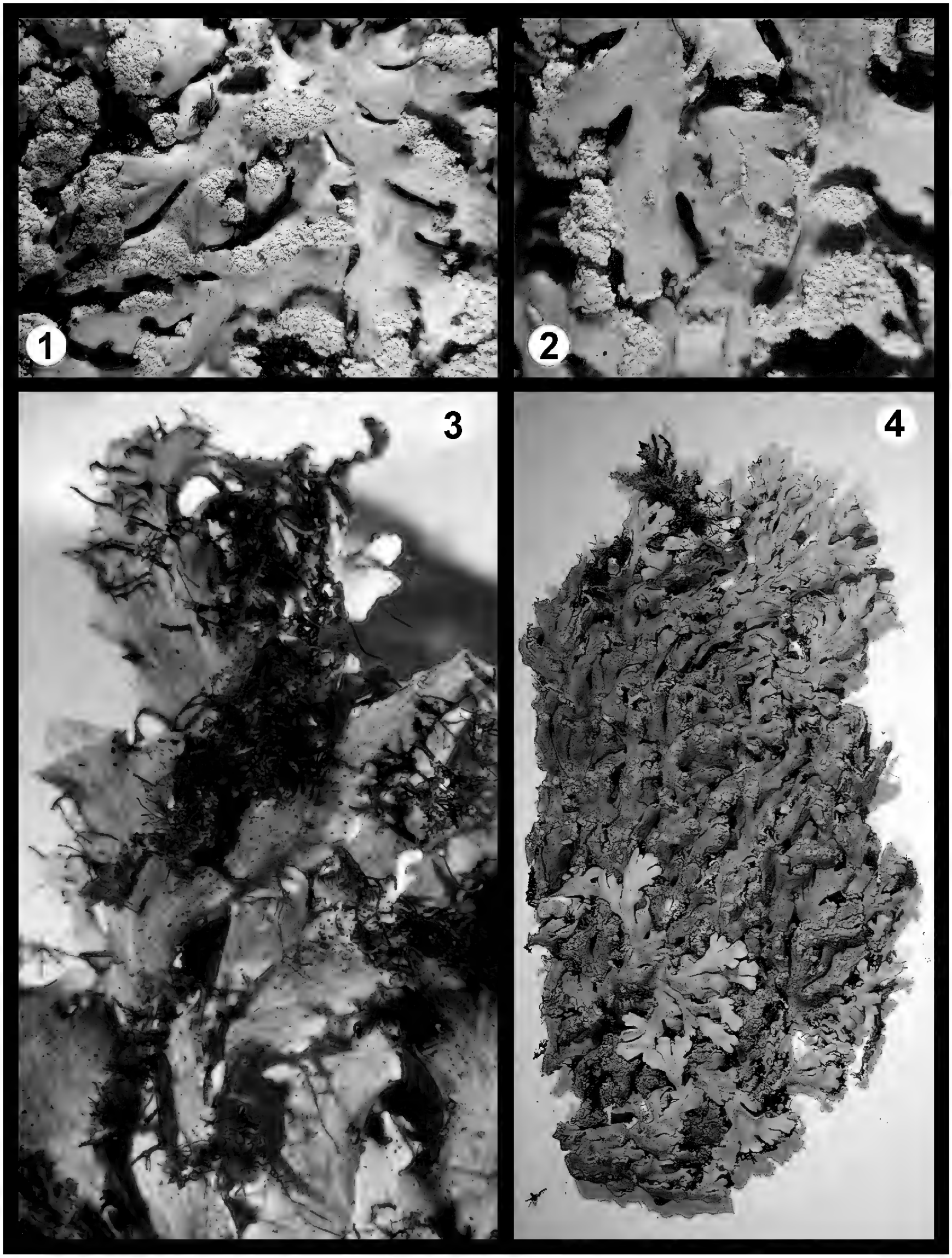

Plate 4. *Heterodermia casarettiana*. Figures 1–2, typical marginal soralia (*Harris 28347*, NY, x10). Figure 3, detail of lower surface with centrally purple zone, followed by orange–yellow pigmented zone and a subsequent narrow white zone near the lobe tips (*Harris 28347*, NY, x10). Figure 4, thallus with typical marginal soralia and irregular laminal soralia on older central portions of the thallus (*Harris 40039*, NY).

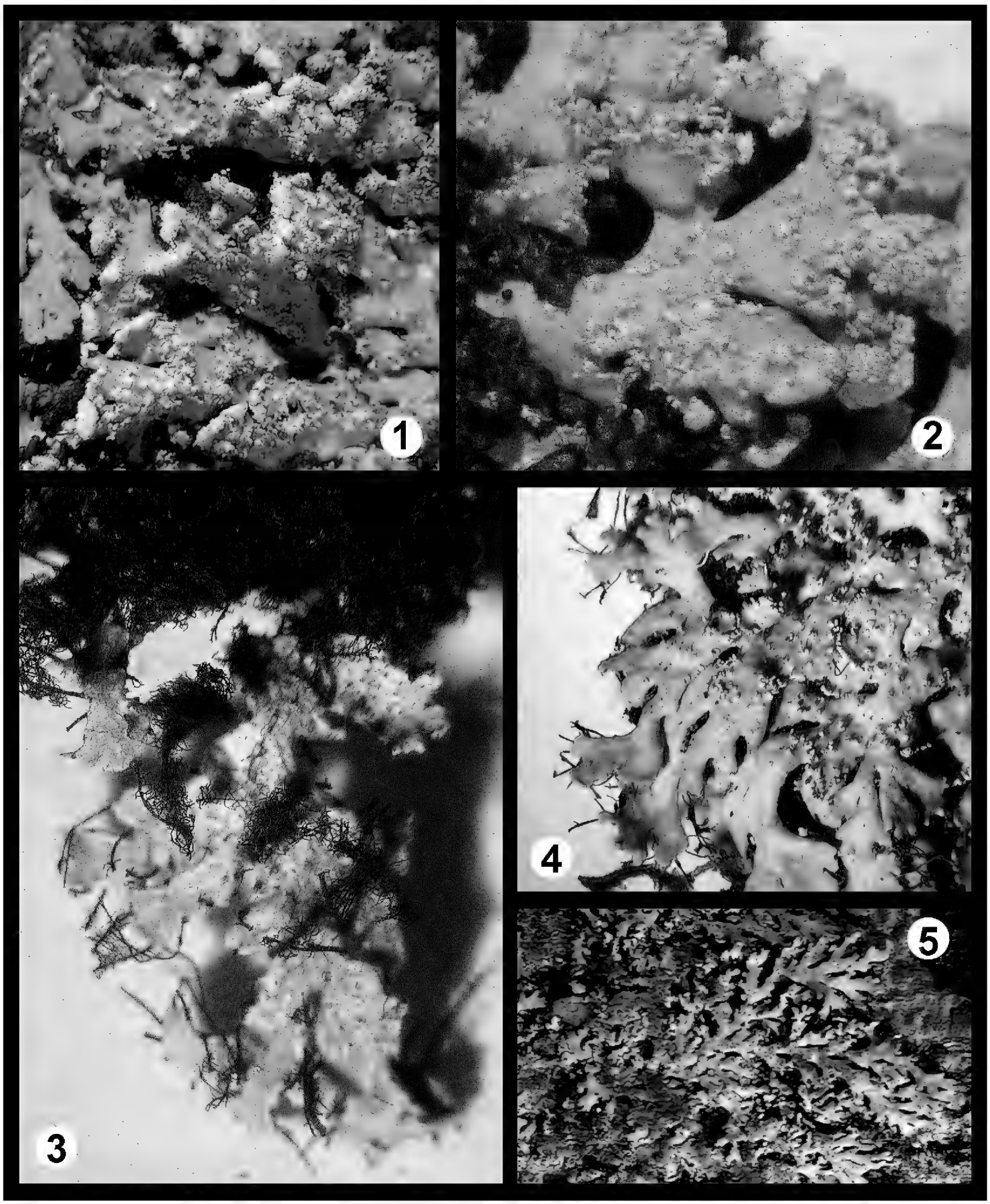

Plate 5. *Heterodermia crocea.* Figures 1–2, coarse marginal soralia and cylindrical laminal isidia (*Beeching s.n.*, NY, x10). Figure 3, lower surface with continuous orange pigment (*Beeching s.n.*, NY, x10). Figure 4, thallus margin and lobes with laminal isidia (*Harris 33135*, NY, x10). Figure 5, thallus (*Lendemer 4725*, NY).

4. *Heterodermia casarettiana* auct. Amer.

Plate 4 (page 9).

Description. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray, though often browned especially in saxicolous thalli; **lobes** long, plane, epruinose, marginally and centrally spreading and flat, the secondary lobes flared and reflexed to reveal the soralia; **medulla** yellow–orange pigmented throughout, or more rarely with pigment lacking in a narrow zone near the tips of the lobes; **underside** ecorticate, centrally purple, with a zone of yellow–orange pigment extending further than the centrally purple regions, and sometimes with a further narrow unpigmented zone near the lobe tips; **pigment** pale yellow–orange, K–, often discolored in herbarium specimens to a reddish–brown; **rhizines** marginal and terminal, dark, squarrose; **soralia** marginal; **soredia** coarse, granular; **apothecia** not seen in eastern North American material.

Chemistry. – Atranorin, zeorin, leucotylin?, norstictic acid, pigment. Spot tests: **cortex** K+ yellow, C–, KC–, P–, UV–; **medulla** K+ yellow turning red, C–, KC+ yellowish, P+ yellow–orange, UV–.

Ecology and distribution. – *Heterodermia casarettiana* is a widespread but infrequent species occurring on rocks and trees of the southern Appalachian Mountains in eastern North America, with scattered disjunct occurrences in the piedmont and coastal plain as well as the Ozarks (see map herein).

Discussion. – As has been discussed by Lendemer et al. (2007) *Heterodermia casarettiana* and *H. japonica* are members of a problematic group of species potentially including *H. neglecta* (= *H. propagulifera* auct.) that requires further study. In the circumscription of *H. casarettiana* followed here the species is widespread in the southern Appalachian Mountains and Piedmont, at middle to low elevations, and tends to be saxicolous rather than corticolous. Morphologically these populations are distinct from other North American populations identified as *H. casarettiana–H. japonica* in containing norstictic acid in the medulla and having an orange–yellow pigmented lower surface with the pigment concentrated away from the lobe tips. Populations from the coastal plain of southeastern North America that have previously been treated as either *H. casarettiana* and/or *H. japonica* by Harris (1995) are morphologically distinct from those of the southern Appalachians and Piedmont and are treated here under the name *H. japonica*. It should be noted that Kurokawa (1962) described the pigment of *H. casarettiana* as being concentrated near the lobe tips rather than in a broad band between the lobe tips and the central darkened portions of the thallus. For this reason I have chosen to use the suffix "auct Amer." above.

Specimens Examined. – **U.S.A. ALABAMA**. CLAY CO.: Talladega National Forest, 24.ix.1992, *R.C. Harris 28354* (NY). CLEBURNE CO.: Mt. Cheaha State Park, 6.vii.2004, *S.Q. Beeching 142* (hb. Beeching). **ARKANSAS**. POPE CO.: Ozark National Forest, Kings Bluff, 14.x.2005, *J.W. Hinds 5034 & P.L. Hinds* (NY). **GEORGIA**. COFFEE CO.: Broxton Rocks Ecological Preserve, 4.ii.1995, *R.C. Harris 36179* (NY). DEKALB CO.: Stone Mountain Park, 4.ii. 2006, *S.Q. Beeching 1158* (hb. Beeching). ELBERT CO.: Willie Smith tract, 26.vii.2008, *S.Q. Beeching 6277* (hb. Beeching). HARRIS CO.: Pine Mountain, 20.viii.2005, *S.Q. Beeching 834* (hb. Beeching). MORGAN CO.: Hard Labor State Park, 23.ii.2008, *S.Q. Beeching 5290* (NY, hb. Beeching). RABUN CO.: Lake Burton Wildlife Management Area, 17.ix.2006, *J.C. Lendemer et al. 7961* (NY). WALKER CO.: Chattahooche National Forest, 23.ix. 1992, *R.C. Harris 28252* (NY). **MISSISSIPPI**. JASPER CO.: Bienville National Forest, 30.iv.1992, *R.C. Harris 28858* (NY). **NORTH CAROLINA**. CLAY CO.: Nantahala National Forest, along Buck Creek Road, 9.x.1998, *R.C. Harris 42732* (NY). JACKSON CO.: Cedar Cliff Mountain, 11.viii.1994, *R.C. Harris 33076* (NY). MACON CO.: Nantahala National Forest, McDowell Mountain, 12.viii.1994, *R.C. Harris 33136* (NY). STOKES CO.: Hanging Rock State Park, 22.ix.1993, *R.C. Harris 30691* (NY). TRANSYLVANIA CO.: Gorges State Park, 12.viii.2005, *J.C. Lendemer 4727 & E. Tripp* (NY). WILKES CO.: Stone Mountain State Park, 23.ix.1993, *R.C. Harris 30746* (NY). **SOUTH CAROLINA**. GREENVILLE CO.: Caesars Head State Park, 14.iii.1997, *R.C. Harris 40039* (NY). **TENNESSEE**. MONROE CO.: Cherokee National Forest, 6.viii.1994, *R.C. Harris 32890* (NY). POLK CO.: Spring Creek, 22.iii.1971, *A.C. Skorepa 6175* (NY). **VIRGINIA**. ALBEMARLE CO.: Nortonsville, 6.iv.1923, *S. Chapman 2023* (NY). DICKENSON CO.: Big Ridge, 16.vi.1964, *C.F. Reed 66880* (NY). LEE CO.: 1 mi N of Ewing, 29.xi. 1969, *C.F. Reed 88992* (NY).

5. *Heterodermia comosa* (Eschw.) Follm. & Redón

Discussion. – Harris (1995a) reported this species for the first time from North America based on a collection from the coastal plain of southeastern Texas. As the occurrence of this species is just outside the area of the present study, it is mentioned here since it may occur in subtropical portions of coastal plain. *Heterodermia comosa* is a small fruticose species with laminal cilia on the lobes and margins of the apothecia. Refer to Kurokawa (1962) for further distinctions from other primarily tropical taxa.

6. *Heterodermia crocea* R.C. Harris

PLATE 2 (PAGE 10).

DESCRIPTION. – **Thallus** foliose, isidio–sorediate and isidiate; **upper surface** gray to blue–gray; **lobes** long, plane, epruinose, spreading; **medulla** white with the lower portions orange pigmented; **underside** ecorticate, with continuous orange pigmentation; **pigment** orange, K+ purple; **rhizines** marginal, dark, squarrose; **isidia** laminal and marginal, cylindrical, often abraded; **soralia** marginal if present; **soredia** isidioid, coarse; **apothecia** not seen in eastern North American material.

CHEMISTRY. – Atranorin, zeorin, leucotylin?, terpenoid 3, pigment. Spot tests: **cortex** K+ yellow, C–, KC–, P + yellowish, UV–; **medulla** K+ yellowish (or K+ purple where pigmented), C–, KC–, P–, UV–.

ECOLOGY AND DISTRIBUTION. – This species is common in southeastern North America, with scattered populations at middle and low elevations of the southern Appalachian Mountains. It is most frequently found on the bark of hardwood trees, but occasionally also occurs on rock.

DISCUSSION. – *Heterodermia crocea* is widely distributed in the southeastern United States, ranging from middle–low elevations of the Appalachian Mountains and throughout the coastal plain. The species can only be confused with *H. neglecta* and *H. obscurata* because of the orange (K+ purple) pigment on the lower surface, but differs from both those species in being isidiate. It should be noted that the isidia in this species are variable and range from true cylindrical isidia to granulose soredioid–isidia.

SPECIMENS EXAMINED. – **U.S.A. FLORIDA**. HIGHLANDS CO.: Archbold Biological Station, 26.iii.1998, *R.C. Harris 41798* (NY). LEON CO.: Apalachicola National Forest, 7.v.1990, *R.C. Harris 25385* (NY). LEVY CO.: Goethe State Forest, 4.xii.1996, *R.C. Harris 38721* (NY). MARION CO.: Ocala National Forest, 2.i.1996, *R.C. Harris 37206* (NY). OKALOOSA CO.: ca. 4 mi S of Crestview, 5.v.1990, *R.C. Harris 25226* (NY). SEMINOLE CO.: Big Tree Park, 6.ii. 1962, *P.O. Schallert L282* (NY). UNION CO.: Lake Butler Wildlife Management Area, 4.xii.1994, *R.C. Harris 36025* (NY). TAYLOR CO.: Aucilla Wildlife Management Area, 12.xii.1993, *R.C. Harris 32265* (NY). VOLUSIA CO.: Blue Spring State Park, 23.iii.1998, *R.C. Harris 41524* (NY). **NORTH CAROLINA**. JACKSON CO.: Bad Creek Trail to Ellicott's Rock, 28.ix.1989, *R.C. Harris 24841* (NY). MACON CO.: Nantahala National Forest, McDowell Mountain, 12.viii.1994, *R.C. Harris 33135* (NY). TRANSYLVANIA CO.: Gorges State Park, 9.viii.2005, *J.C. Lendemer 4725 & E. Tripp* (NY).

7. *Heterodermia echinata* (Taylor) W.R. Culb.

DESCRIPTION. – **Thallus** foliose, not sorediate or isidiate; **upper surface** gray to blue–gray; **lobes** long, ascending, epruinose; **medulla** white; **underside** ecorticate, white; **rhizines** pale, simple, marginal; **apothecia** terminal on the lobe tips.

CHEMISTRY. – Atranorin, zeorin. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

ECOLOGY AND DISTRIBUTION. – *Heterodermia echinata* is widespread in southeastern North America and the Ozarks, usually occurring on the branches of trees along forest margins and openings.

DISCUSSION. – No other species of *Heterodermia* in eastern North America has ascending lobes and abundant apothecia. The species is also distinctive for not producing terpenoids in addition to zeorin.

SPECIMENS EXAMINED. – **U.S.A. ALABAMA**. LEE CO.: Auburn, 25.xi.1897, *F.S. Earle & C.F. Baker 171* (NY). **ARKANSAS**. BENTON CO.: Hobbs State Park–Conservation Area, 16.x.2005, *W.R. Buck 49516* (NY). CRAWFORD CO.: Ozark National Forest, 15.iv.2004, *R.C. Harris 49147* (NY). MONTGOMERY CO.: 10 km N of Mount Ida, 24.v. 1988, *W.L. Culberson 20670* (NY). NEWTON CO.: Ozark National Forest, 28.iii.2006, *J.C. Lendemer et al. 6569* (NY). SEARCY CO.: along St. Rd. 14, 25.iv.1988, *W.R. Buck 15852* (NY). **FLORIDA**. BAY CO.: N of Fla Hwy 20, 1.xii.1994, *W.R. Buck 27262* (NY). COLUMBIA CO.: Ichetucknee Springs State Park, 2.xii.1992, *W.R. Buck 22608* (NY). DIXIE CO.: Steinhatchee Wildlife Management Area, 4.xii.1993, *W.R. Buck 24358* (NY). HAMILTON CO.: Holton Creek Wildlife Management Area, 14.xii.1993, *R.C. Harris 32470–A* (NY). LEON CO.: Apalachicola National Forest, Leon Sinks Geological Area, 2.xii.1988, *R.C. Harris 28284* (NY). MARION CO.: Florida Greenways along Oklawaha River, 2.i.1996, *R.C. Harris 37185* (NY). SUWANNEE CO: Little River Sink, 5.xii.1994, *R.C. Harris*

36063 (NY). WAKULLA CO.: Edward Ball Wakulla Springs State Park, 26–27.xii.1990, *W.R. Buck 18983* (NY). WALTON CO.: Lakewood, 30.xi.1988, *W.R. Buck 16515* (NY).**GEORGIA**. CLARKE CO.: East Athens, 2.x.1992, *R.C. Harris 28933* (NY). COLUMBIA CO.: Heggie's Rock Preserve, 6.x.1999, *W.R. Buck 36547* (NY). **ILLINOIS**. UNION CO.: Cobden, iii.1881, *F.S. Earle s.n.* (NY). **IOWA**. FAYETTE CO.: sine loc., vii.1894, *B. Fink s.n.* (NY). **LOUISIANA**. NATCHITOCHES PARISH.: Natchitoches, 25.ix.1886, *A.B. Langlois 73* (NY). ST. MARTIN PARSIH.: near St. Martinsville, 24.iii.1890, *A.B. Langlois 138* (NY). **MISSISSIPPI**. JASPER CO.: Bienville National Forest, 30.ix.1992, *W.R. Buck 22106* (NY). WILKINSON CO.: Clark Creek Natural Area, 5.iv.1982, *J. Pruski 2584* (NY). **MISSOURI**. BARRY CO.: Roaring River State Park, 3.xi.2000, *R.C. Harris 44725* (NY). MCDONALD CO.: Huckleberry Ridge Conservation Area, 29.x.2000, *R.C. Harris 44208* (NY). OZARK CO.: Caney Mountain Conservation Area, 4.viii.1999, *W.R. Buck 36016* (NY). PERRY CO.: Perryville, iv.1886, *C.H. Demetrio 27* (NY). TANEY CO.: Ruth and Paul Henning Conservation Area, 5.xi.2002, *R.C. Harris 46726* (NY). **NORTH CAROLINA**. JACKSON CO.: Cullowhee, vi–vii.1887, *R. Thaxter s.n.* (NY). WAKE CO.: Rte. 96, 3 mi past intersection with Rte. 98, 2.iii.1967, *S.B. Pravda s.n.* (NY). **OHIO**. CHAMPAIGN CO.: Urbana, 7.xii.1877, *H.J. Biddlecome s.n.* (NY). **SOUTH CAROLINA**. CHESTER CO.: Chester, 9.iv.1898, *H.A. Green s.n.* (NY). DORCHESTER CO.: Harleyville, 10.ii.1981, *S. Stein s.n.* (NY). LANCASTER CO.: Forty Acre Rock, 15.iii.1997, *R.C. Harris 40150* (NY). **VIRGINIA**. MONTGOMERY CO.: Blacksburg, xii.1902, *V. Murrill s.n.* (NY).

8. *Heterodermia erecta* Lendemer sp. nov.

MycoBank #512894.

Plate 6 (page 14).

Ab *H. hypoleuca* lobis brevioribus, erectioribus, sorediosis differt.

Type: **U.S.A. NORTH CAROLINA**. GRAHAM CO.: Nantahala National Forest, Cherohala Skyway [NC 143], Mudd Gap, elev. 1388 m., *Fagus*–dominated hardwood forest, on bole of fallen *Fagus*, 1.x.1997, *R.C. Harris 41044* (NY, holotype).

Description. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** short and plane, epruinose; marginal lobes +/– flat and spreading, with only the central and secondary lobes becoming +/– erect; central and secondary lobes strongly erect and perpendicular to the thallus, unidirectional; **medulla** white; **underside** ecorticate, white, unpigmented, often darkening to brownish toward the center of the thallus; **rhizines** black, squarrose, marginal; **soralia** sub–terminal, on the lower surface of the lobe tips; **soredia** fine, granular; **apothecia** not seen in the available material.

Chemistry. – Atranorin, zeorin, leucotylin?. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

Ecology and distribution. – The new species is known only from hardwood forests of high elevations of the southern Appalachian Mountains of eastern North America. Known porophytes include hickory (*Carya*), beech (*Fagus*), and oak (*Quercus*).

Discussion. – *Heterodermia erecta* is apparently endemic to hardwood forests of high elevations of the southern Appalachian Mountains in eastern North America. It is characterized by the presence of sorediate erect lobes in the central portions of the thallus. The only other species in North America with which this species could be confused is *H. galactophylla* however, that taxon has narrow spreading lobes and strongly reflexed labriform soralia. This species could be confused with *H. microphylla*, a species whose occurrence in North America is doubtful (see discussion under that name); however *H. microphylla* lacks the sorediate erect lobes of *H. erecta* and, instead, has apressed lobes that are marginally phyllidiate/lobulate as in *H. squamulosa*.

Despite the extensive field work that has been carried out by lichenologists in the Appalachian Mountains, particularly for macrolichens, this species has been found only a handful of times. The lack of collections would seem to indicate that the species is rare in light of its apparently endemic nature it may require protection at the state or federal level.

Additional Specimens Examined. – **U.S.A. GEORGIA**. TOWNS CO.: Southern Nantahala Wilderness, Chattachooche National Forest, Hightower Gap to Rich Knob, 11.xi.2007, *J.C. Lendemer et al. 10939* (NY). UNION CO.: Woody Gap, 30.xii.2006, *S.Q. Beeching 2242* (NY, hb. Beeching). **NORTH CAROLINA**. MACON CO.: Nantahala National Forest, Wayah Bald, 30.ix.1997, *R.C. Harris 40982* (NY).

9. *Heterodermia galactophylla* (Tuck.) Culb.

PLATE 7 (PAGE 16).

DESCRIPTION. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** long, plane, spreading, epruinose, with the secondary lobes bearing soralia reflexed and erect in marked contrast to the plane primary lobes; **medulla** white; **underside** ecorticate, white; **rhizines** pale to somewhat darkened near tips, thyrsiform, marginal; **soralia** labriform, on flared and erect secondary lobes in central portions of the thallus; **soredia** fine, granular; **apothecia** not seen in eastern North American material.

CHEMISTRY. – Atranorin, zeorin. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

ECOLOGY AND DISTRIBUTION. – This is a rare species with an enigmatic distribution in eastern North America. The lack of collections may indicate that it has been overlooked. It has been consistently collected on the bark of conifers.

DISCUSSION. – The scattered occurrences of *Heterodermia galactophylla* in eastern North America are puzzling. Either the species is overlooked (which is doubtful considering its distinctive appearance) or it is truly rare, with the modern occurrences representing relict populations from areas that have a protective climate (e.g. constant high humidity and cool temperatures) that has allowed the species to persist (while disappearing elsewhere in its historical range). The species could be confused with some abnormal forms of *H. speciosa;* however the lower surface in that species is corticate.

SPECIMENS EXAMINED. – U.S.A. **FLORIDA**. LEVY CO.: along St. Rd. 24, 0.9 mi SW of Alachua County line, 31.xii. 1995, *R.C. Harris 37107* (NY). MARION CO.: just E of Oklawaha River on Fla. Hwy. 316, 10.viii.1985, *R.C. Harris 18035* (NY). **MINNESOTA**. COOK CO.: Boundary Waters Canoe Area, 21.ix.1986, *C.M. Wetmore 57425* (NY). **NEW YORK**. WYOMING CO.: Arcade, xi.1871, *M.L. Wilson s.n.* (BUF). **VERMONT**. WINDHAM CO.: Newfane, 26.vii.1895, *M.A. Howe 12* (NY).

10. *Heterodermia granulifera* (Ach.) Culb.

PLATE 8 (PAGE 17).

DESCRIPTION. – **Thallus** foliose, isidiate; **upper surface** gray to blue–gray; **lobes** short, plane, often pruinose, spreading; **medulla** white; **underside** corticate, pale to light brown centrally; **rhizines** pale, short, simple, primarily marginal; **isidia** laminal, short, globose, granular **or** cylindrical and tall; **apothecia** not seen in eastern North American material.

CHEMISTRY. – Atranorin, zeorin, salazinic acid agg. (± hyposalazinic acid in some populations). Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K+ yellow turning red, C–, KC–, P+ orange, UV–.

ECOLOGY AND DISTRIBUTION. – This species is widespread in Appalachian Mountains and Piedmont of eastern North America, with disjunct populations in the Ozark Ecoregion.

DISCUSSION. – *Heterodermia granulifera* is one of only two isidiate species in eastern North America and is separated from the other, *H. crocea*, by containing salazinic acid and having a corticate unpigmented lower surface. The species is not easily confused with any other in the region. Further study is needed to determine if the presence of hyposalazinic acid in some populations may correspond with geographic distribution and isidium morphology (short globose vs. tall cylindrical).

SPECIMENS EXAMINED. – **U.S.A. ARKANSAS**. MADISON CO.: Madison County Wildlife Management Area, 2.xi.2000, *R.C. Harris 44683* (NY). **KENTUCKY**. RUSSELL CO.: Rte. 127 near Wolf Creek, 12.vii.1980, *C.F. Reed 110013* (NY). **MISSOURI**. BUTLER CO.: University Forest Conservation Area, 23.x.2001, *R.C. Harris 45311* (NY). CRAWFORD CO.: Woodson K. Woods Memorial Conservation Area, 25.iii.2006, *J.C. Lendemer et al. 6090* (NY). FRANKLIN CO.: Meramec State Park, 23.iii.2006, *J.C. Lendemer et al. 5936* (NY). PHELPS CO.: Mark Twain National Forest, Bradford Branch, 8.v.1994, *D. Ladd et al. 18036* (NY). SHANNON CO.: Ozark National Scenic Riverways, Round Spring, 25.ix.1990, *R.C. Harris 25964* (NY). SHARP CO.: Strawberry River Preserve, 25.x.2001,

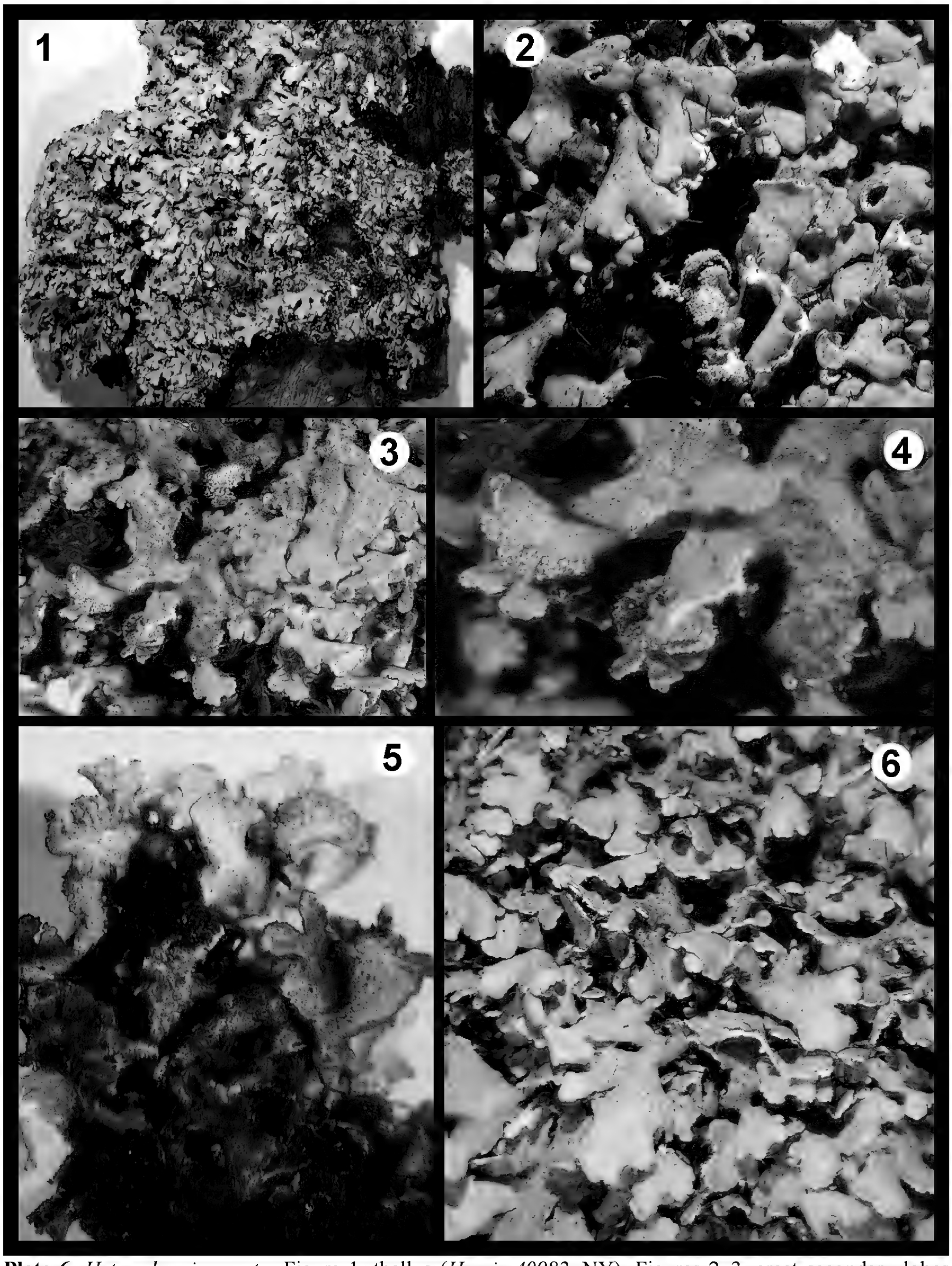

Plate 6. *Heterodermia erecta*. Figure 1, thallus (*Harris 40982*, NY). Figures 2–3, erect secondary lobes with soralia (*Harris 41044*, NY, x10). Figure 4, detail of soralia from above (*Harris 41044*, NY, x20). Figure 5, underside (*Harris 41044*, NY, x10). Figure 6, typical short erect lobes of thallus (*Harris 41044*, NY, x10).

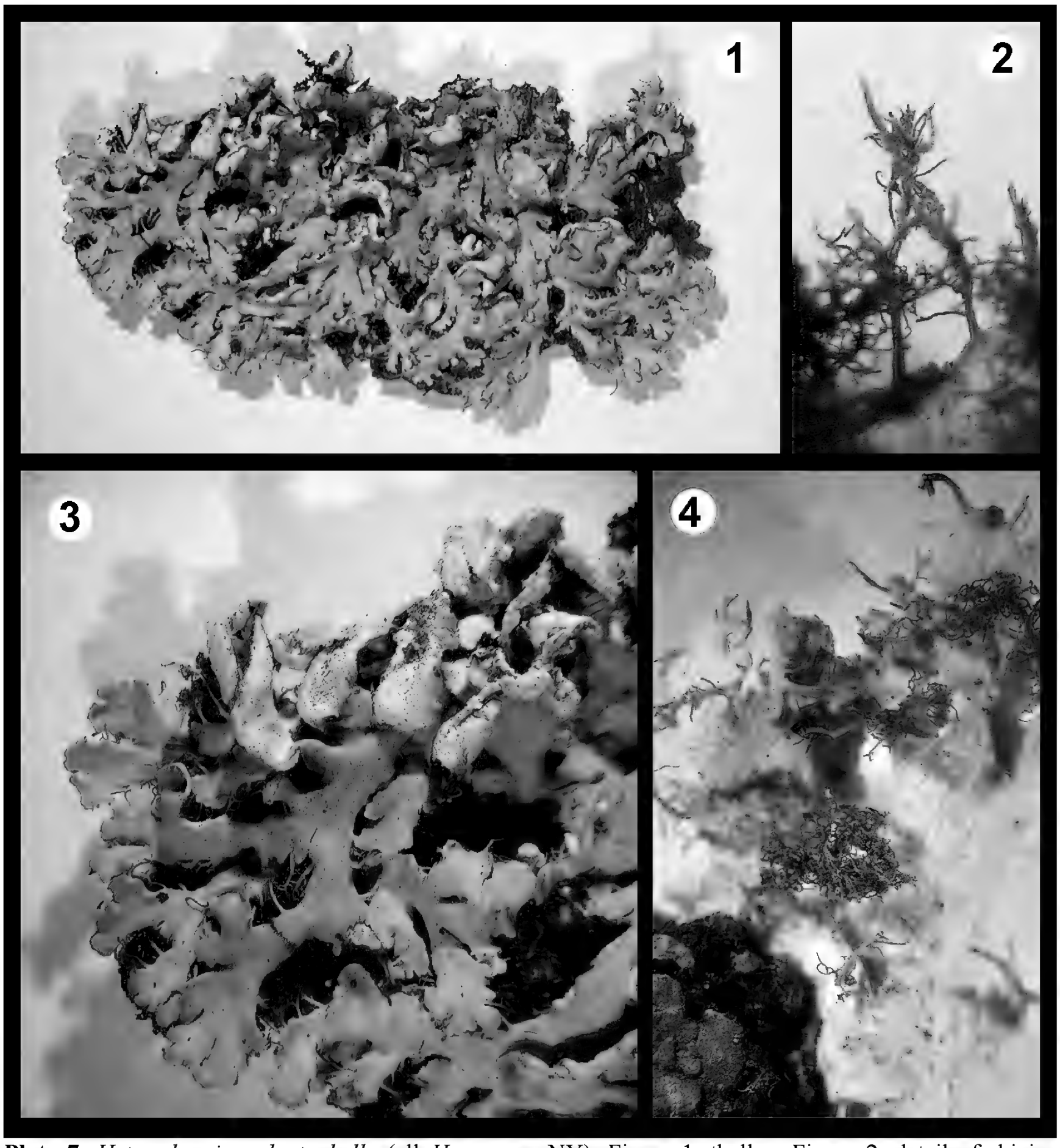

Plate 7. *Heterodermia galactophylla* (all *Howe s.n.*, NY). Figure 1, thallus. Figure 2, detail of rhizine (x20). Figure 3, detail of thallus and morphology of soralia (x10). Figure 4, lower surface (x15).

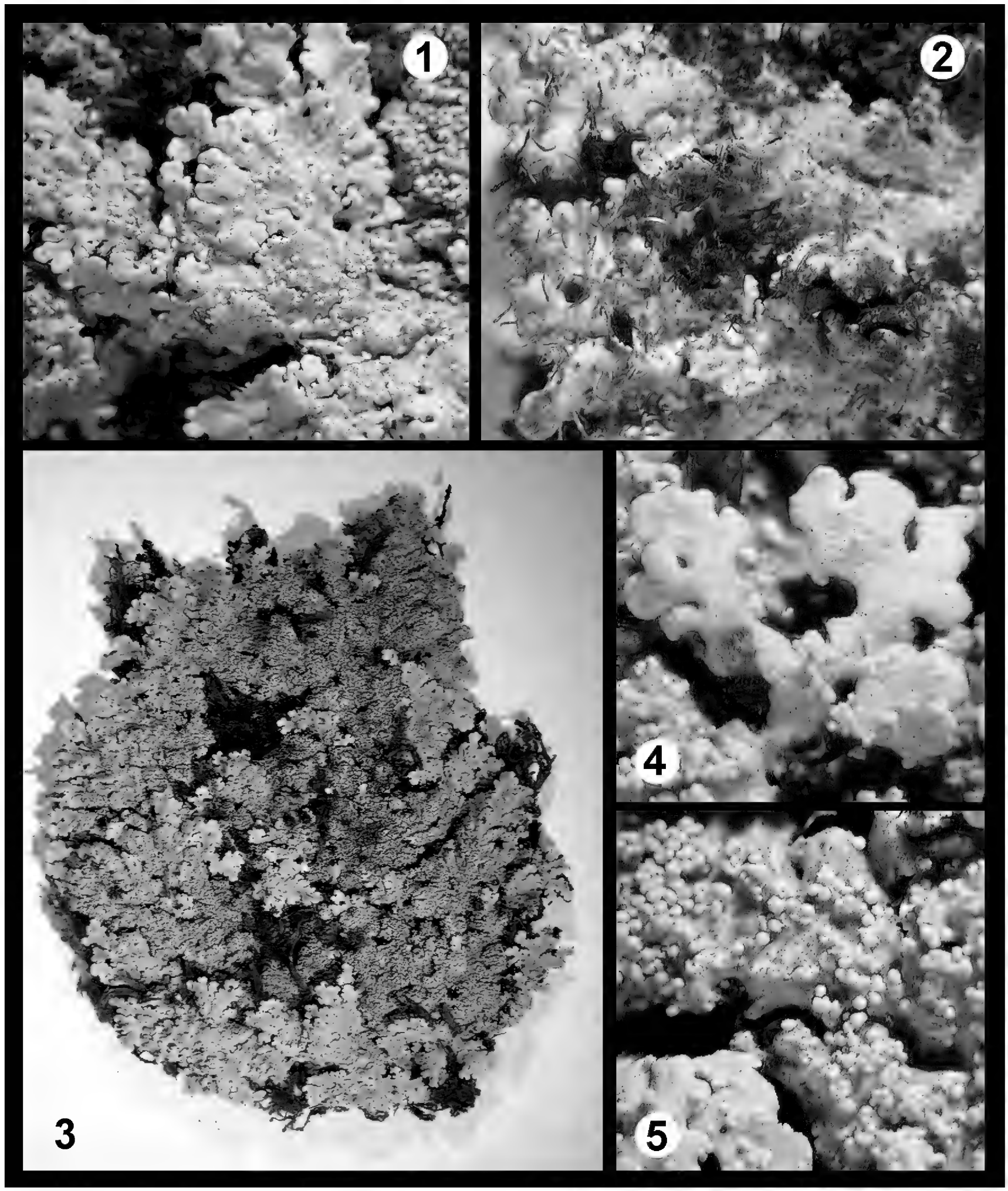

Plate 8. Heterodermia granulifera (all Harris 44683, NY). Figure 1, detail of upper surface (x10). Figure 2, detail of lower surface and rhizines (x10). Figure 3, thallus. Figure 4, pruinose lobe tip (x20). Figure 5, short granulose isidia (x20).

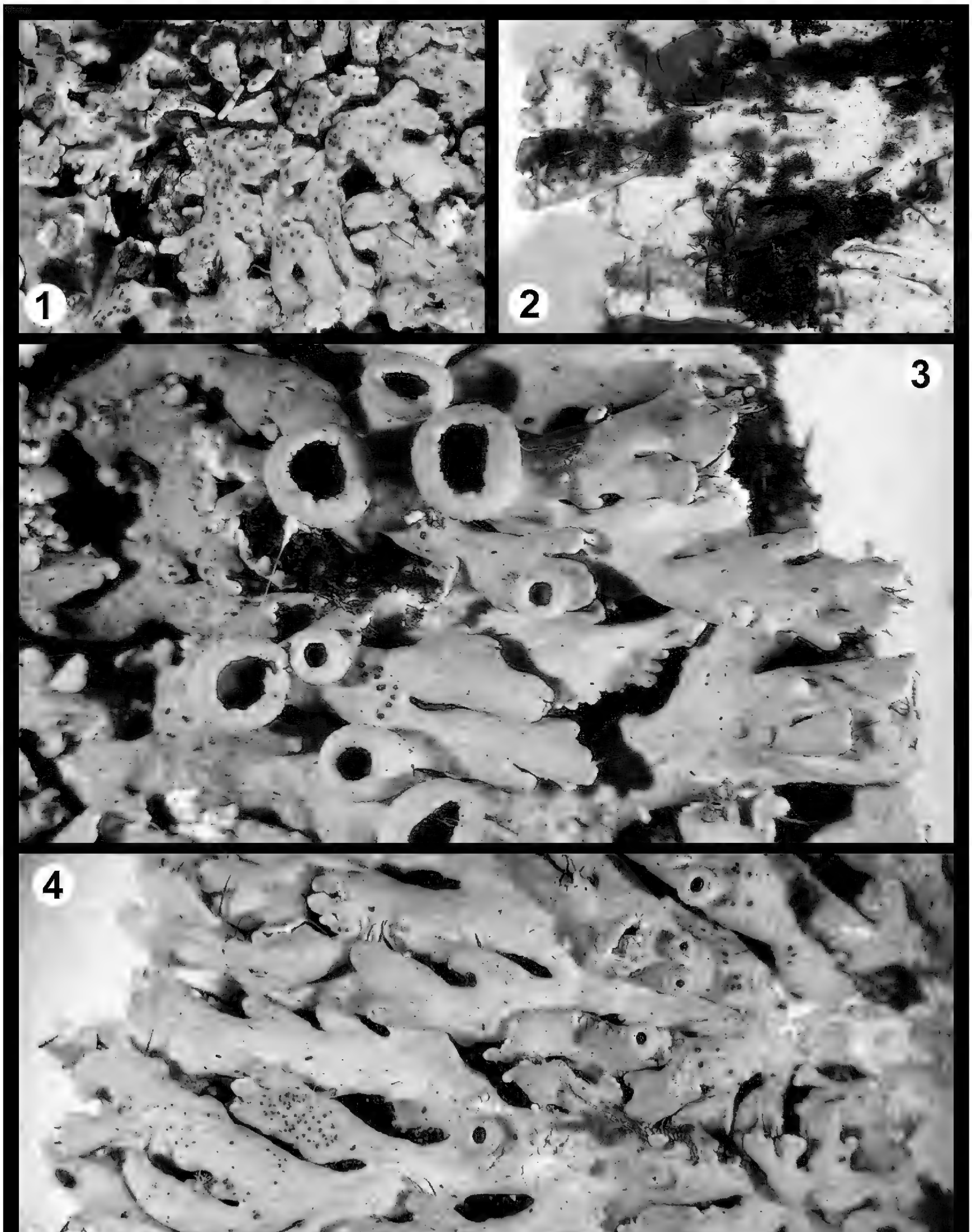

Plate 9. Heterodermia hypoleuca (all Harris 36665, NY). Figure 1, secondary lobes near central portions of thallus (x10). Figure 2, underside (x10). Figures 3–4, typical lobes and apothecia (x20).

R.C. Harris 45522 (NY). WASHINGTON CO.: Mark Twain National Forest, Little Pilot Knob, 24.v.2003, *R.C. Harris 47922* (NY). WAYNE CO.: Coldwater Conservation Area, 22.x.2001, *R.C. Harris 45152* (NY). **NORTH CAROLINA**. JACKSON CO.: Cedar Cliff Mountain, 11.viii.1994, *R.C. Harris 33017* (NY). MCDOWELL CO.: 10 mi N of Marion, vi.1936, *G.P. Anderson s.n.* (NY). ORANGE CO.: Route 54, vi.1935, *G.P. Anderson s.n.* (NY). **OKALHOMA**. SEQUOYAH CO.: Sallisaw–Brushy Lake State Park, 1.xi.2000, *R.C. Harris 44575* (NY). **VIRGINIA**. GILES CO.: Cascades Recreation Area, 23.vi.1978, *R.C. Harris 12900* (NY). ROCKINGHAM CO.: Island Ford, 11.vi.1964, *C.F. Reed 67649* (NY). SCOTT CO.: Hintons, 15.vi.1964, *C.F. Reed 67678* (NY). SMYTH CO.: Brushy Mountain, 4.vi.1892, *J.K. Small s.n.* (NY).

11. *Heterodermia hypoleuca* (Ach.) Trevis.

Plate 9 (page 18).

Description. – **Thallus** foliose, not sorediate or isidiate; **upper surface** gray to blue–gray; **lobes** long, plane, spreading, often developing short secondary lobes in the central portions of the thallus; **medulla** white; **underside** ecorticate, pale throughout; **rhizines** dark, squarrose, marginal; **apothecia** common, laminal, often with squamulose margins.

Chemistry. – Atranorin, zeorin, leucotylin?, terpenoid 3. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

Ecology and distribution. – This is a widespread and common species occurring on hardwoods throughout eastern North America.

Discussion. – *Heterodermia hypoleuca* is the only apotheciate species with non–ascending lobes known to occur in eastern North America. Occasional specimens with abundant marginal lobes and lobulate apothecial margins have been misidentified as *H. microphylla* (Kurok.) Skorepa, a Japanese species which is apparently similar to *H. squamulosa* (Degel.) Culb. (see discussion of *H. microphylla* below).

Specimens Examined. – **U.S.A. ALABAMA**. CLAY CO.: Cheaha State Park, 24.ix.1992, *R.C. Harris 28309* (NY). **ARKANSAS**. BENTON CO.: Ozark National Forest, Wedington Wildlife Management Area, 12.iv.2004, *R.C. Harris 48762* (NY). CARROLL CO.: near Green Forest, v.1954, *M.E. Hale 2789* (NY). CONWAY CO.: Ozark National Forest, Cedar Mountain, 8.xi.2002, *R.C. Harris 46978* (NY). JOHNSON CO.: Ozark National Forest, Devils Knob, 17.iv.2004, *R.C. Harris 49348* (NY). IZARD CO.: NE corner of Devil's Knob–Devil's Backbone Natural Area, 24.x. 2001, *R.C. Harris 45346* (NY). POPE CO.: Ozark National Forest, 7.xi.2002, *R.C. Harris 46917–A* (NY). **CONNECTICUT**. LITCHFIELD CO.: West Goshen, viii.1898, *L.M. Underwood s.n.* (NY). **GEORGIA**. MURRAY CO.: Chattahoochee National Forest, Cohutta Wilderness, 22.ix.1992, *R.C. Harris 28145* (NY). RABUN CO.: Chattahoochee National Forest, Rabun Bald, 20.ix.1996, *R.C. Harris 38950* (NY). UNION CO.: Chattahoochee National Forest, along Duncan Ridge Trail from Wildcat Gap to Coosa Bald, 6.x.1998, *R.C. Harris 42524* (NY). WALKER CO.: Chattahoochee National Forest, Johns Mountain Overlook, 23.ix.1992, *R.C. Harris 28232* (NY). **ILLINOIS**. FULTON CO.: Canton, *sine legit s.n.* (NY). UNION CO.: Cobden, 9.iii.1879, *F.S. Earle s.n.* (NY). **IOWA**. FAYETTE CO.: Fayette, vii.1893, *B. Fink s.n.* (NY). **KENTUCKY**. HARLAN CO.: Kentenia State Forest, 16.ix.1991, *R.C. Harris 27143* (NY). **MAINE**. HENNEPIN CO.: Orono, *C.W. Knight 12* (NY). OXFORD CO.: Norway, 13.xii.1931, *G.L. Bacon 9920* (NY). **MASSACHUSETTS**. LAFAYETTE CO.: Cambridge, s.d., *E. Tuckerman s.n.* (NY). NORFOLK CO.: Wellesley, vi.1892, *V.J. Libbey 56* (NY). WORCESTER CO.: Worcester, 1887, *G.E. Stone s.n.* (NY). **MICHIGAN**. EMMET CO.: Cross Village, 27.vii.1958, *H. Robinson & H.A. Crum s.n.* (NY). **MISSOURI**. CARTER CO.: Peck Ranch Conservation Area, 16.iv.1997, *R.C. Harris 40409* (NY). DENT CO.: Indian Trail Conservation Area, 3.xi.2004, *R.C. Harris 50191* (NY). DOUGLAS CO.: Shannon Ranch Conservation Area, 19.v.2003, *R.C. Harris 47309* (NY). GASCONADE CO.: Canaan Conservation Area, 25.iii.2006, *J.C. Lendemer et al. 6036* (NY). LACLEDE CO.: Bear Creek Conservation Area, 4.xi.2002, *A. Amtoft 430* (NY). MADISON CO.: Mark Twain National Forest, Rock Pile Mountain Wilderness, 14.x.2003, *R.C. Harris 48287* (NY). MARIES CO.: jct. of Hwy. 42 and Little Maries River, 27.iv.1980, *D. Castaner 6042* (NY). OREGON CO.: Mark Twain National Forest, Greer Spring Trail, 18.x.2003, *W.R. Buck 45575* (NY). OZARK CO.: Mark Twain National Forest, Smoke Tree Scenic Lookout, 18.iv.1997, *R.C. Harris 40589* (NY). PHELPS CO.: Mark Twain National Forest, Bradford Branch woodland restoration area, 4.x.1993, *D. Ladd 17540* (NY). ST. FRANCOIS CO.: just W of Knob Lick Fire Tower, 19.ix.1990, *R.C. Harris 25484* (NY). TANEY CO.: Along W side of MO 125 ca. 0.9 mi N of Hercules Tower Road, 18.iv.1997, *R.C. Harris 40693* (NY). **NEW HAMPSHIRE**. GRAFTON CO.: North Groton, vi.1879, *J. Blake 13* (NY). **NEW YORK**. DUTCHESS CO.: Poughkeepsie, *sine legit s.n.* (NY). ERIE CO.: Buffalo, *sine legit s.n.* (NY). ONANDAGA CO.: Syracuse, ii.1887, *sine legit s.n.* (NY). WASHINGTON CO.: Shushan, 27.v.1905, *F. Dobbins s.n.* (NY). YATES CO.: Penn Yan, 1847, *H.P. Sartwell s.n.* (NY). **NORTH CAROLINA**. ALLEGHANY CO.: NW of Sparta, 13.vi. 1964, *C.F. Reed 67164* (NY). GRAHAM CO.: Nantahala National Forest, Cherohala Skyway, 1.x.1997, *R.C. Harris*

41029 (NY). JACKSON CO.: Nantahala National Forest, 2 slope of Piney Ridge Knob, 7.x.1998, *R.C. Harris 42680* (NY). WILKES CO.: Stone Mountain State Park, 23.ix.1993, *R.C. Harris 30774* (NY). **OKALAHOMA**. ADAIR CO.: Cookson Hills Wildlife Management Area, 1.xi.2000, *R.C. Harris 44464–A* (NY). CHEROKEE CO.: Cookson Wildlife Management Area, 14.iv.2004, *R.C. Harris 48979* (NY). **PENNSYLVANIA**. HUNTINGTON CO.: State College Nature Camp, viii.1933, *F.A. Wiley s.n.* (NY). **SOUTH CAROLINA**. GREENVILLE CO.: Caesar's Head, 22.iv.1967, *C.F. Reed 107291* (NY). **TENNESSEE**. CUMBERLAND CO.: Crab Orchard Mountain, 13.x.1962, *A.J. Sharp L–130* (NY). JACKSON CO.: Cub Creek Community, 22.iv.1996, *L.R. Phillippe 27103* (NY). HICKMAN CO.: Middle Tennessee State University Wildlife Management Area, 28.xi.1997, *L.R. Phillippe 29558* (NY). **VERMONT**. WINDHAM CO.: Newfane, 26.vii.1895, *M.A. Howe s.n.* (NY). **VIRGINIA**. ACCOMACK CO.: Oak Hall, 3.ix.1934, *G.P. Anderson s.n.* (NY). GILES CO.: Mountain Lake Biological Station, 24.vi.1978, *R.C. Harris 12946* (NY). PATRICK CO.: Blue Ridge Parkway, 6.x.1995, *R.C. Harris 36665* (NY). ROCKINGHAM CO.: Rt 33 nr Skyline Drive, 11.vi.1964, *C.F. Reed 67273* (NY). WARREN CO.: Shenandoah National Park, 13.iii.2005, *J.C. Lendemer 3871* (NY). **WEST VIRGINIA**. POCAHONTAS CO.: Cass, 13.xii.1928, *F.W. Gray L1921* (NY).

12. *Heterodermia japonica* (Sato) Swinscow & Krog

Plate 10 (page 21).

Description. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** long, plane, epruinose, marginally and centrally spreading and flat, the secondary lobes flared and reflexed to reveal the soralia; **medulla** white **or** with lemon yellow pigment in the lower layers near the lobe tips and soralia; **underside** ecorticate, pale white to dirty brown or purplish, without yellow pigment **or** with lemon yellow pigment concentrated near the lobe tips and in the soralia; **pigment** pale yellow to lemon yellow, K± dark brown, when present restricted to the lobe tips and soralia; **rhizines** marginal and terminal, dark, squarrose; **soralia** marginal; **soredia** fine, granular, occasionally pigmented; **apothecia** not seen in eastern North American material.

Chemistry. – Atranorin, zeorin, terpenoid 1, leucotylin?, ± norstictic acid ± yellow pigment. Spot tests, **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC– P–, UV– **or** K+ yellow turning red, C–, KC–, P+ yellow, UV–.

Ecology and distribution. – *Heterodermia japonica* appears to be restricted to the coastal plain and piedmont of southeastern North America. The species is known only from the bark of hardwoods.

Discussion. – This taxon has long been somewhat of an enigma in North America (Harris 1995, Lendemer et al. 2007) and has often been confused with *H. neglecta* or with *H. casarettiana* as circumscribed here (see these taxa for discussion). Kurokawa (1962) considered *H. japonica* to have an unpigmented underside and recognized norstictic acid producing and norstictic acid deficient populations as distinct infraspecific taxa. Moberg and Nash (2002) broadened the concept of *H. japonica* significantly to include both norstictic acid producing and acid deficient chemotypes as well as specimens with marginally pigmented undersides (e.g., those referable to *H. casarettiana* (A. Massal.) Trevis. as per Moberg (2004)), a view to which Lendemer et al. (2007) objected. Subsequent examination of the North American material referred to *H. japonica* by Harris (1995) has led me to agree with Moberg and Nash (2002), at least until a molecular analysis of this group of morphotypes is undertaken. Both norstictic acid producing and norstictic acid deficient populations occur in the coastal plain of southeastern North America. Populations in which the underside is marginally pigmented also occur, as do populations which are totally devoid of pigment. Unfortunately, the different types of pigmentation do not correlate with the presence or absence of norstictic acid and thus either the North American material represents a single polymorphic taxon or an aggregate of closely related taxa differing in pigmentation and medullary chemistry. Further complicating matters is the fact that the pigment present in *H. casarettiana* as circumscribed by Kurokawa (1962) is concentrated near the lobe tips, while that of *H. casarettiana* as circumscribed here is concentrated away from the lobe tips and closer to the central portions of the thallus (see figures herein). It should be noted that *H. casarettiana* as circumscribed here also has a terpenoid profile different from that of *H. japonica*.

Selected Specimens Examined. *[NORSTICTIC ACID CHEMOTYPE]* – **U.S.A. ALABAMA**. TALLAPOOSA CO.: Tallapoosa region, 12.ii.1897, *F.S. Earle s.n.* (NY). **FLORIDA**. MARION CO.: just E of Oklawaha River, 10.viii. 1985, *R.C. Harris 18059* (NY). VOLUSIA CO.: Blur Spring State Park, 23.iii.1998, *R.C. Harris 41539* (NY), *R.C. Harris 41559* (NY). **GEORGIA**. CALHOUN CO.: Chickasawhatchee Wildlife Management Area, 1.iii.2008, *S.Q. Beeching 5356* (hb. Beeching).

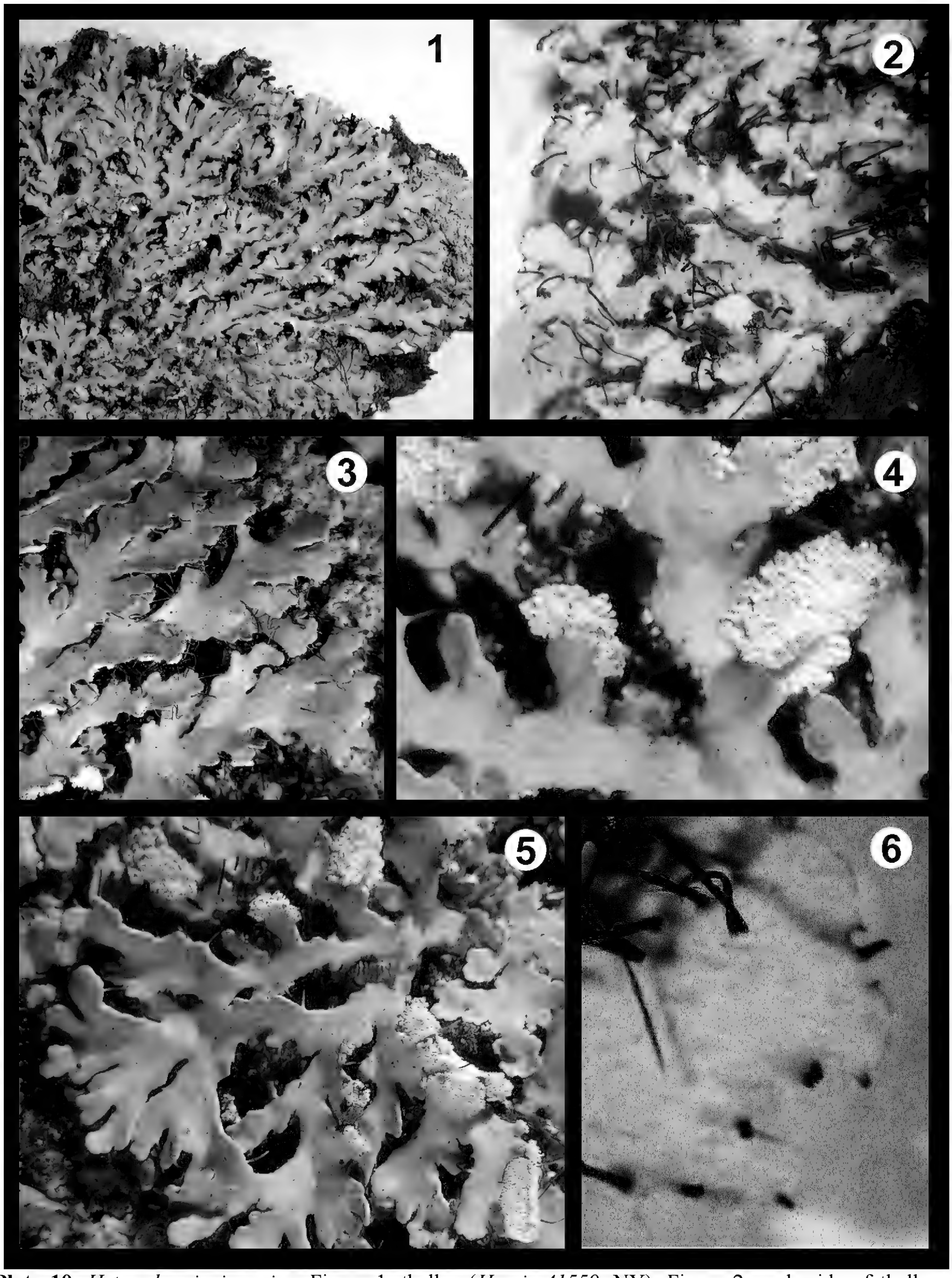

Plate 10. *Heterodermia japonica*. Figure 1, thallus (*Harris 41559*, NY). Figure 2, underside of thallus lacking pigment, compare to figure 6 below (*Harris 41559*, NY, x10). Figure 3, marginal lobes (*Harris 41559*, NY, x10). Figure 4, morphology of soralia (*Harris 41559*, NY, x20). Figure 5, central portions of thallus (*Harris 41559*, NY, x10). Figure 6, underside of lobe tip of a thallus with "*casarettiana*"-like pigmentation (*W.R. Buck 15454*, NY, x30).

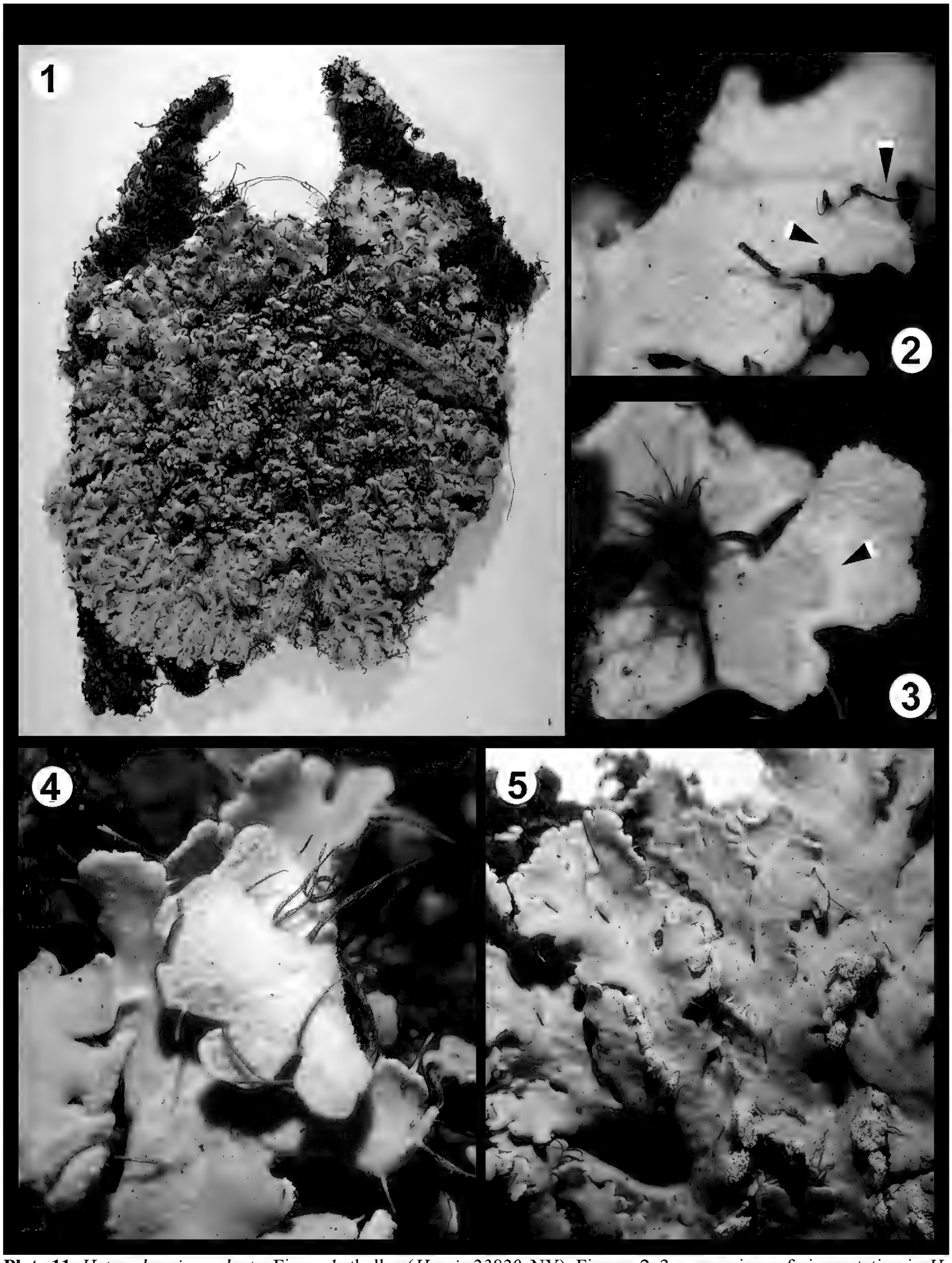

Plate 11. *Heterodermia neglecta*. Figure 1, thallus (*Harris 23820*, NY). Figures 2–3, comparison of pigmentation in *H. neglecta* (fig. 2, *Harris 52546*, NY, x2.5) and *H. obscurata* (fig. 3, *Harris 30759*, NY, x2.5). Figure 4, underside of lobe tip (*Harris 23820*, NY, x15). Figure 5, detail of lobe morphology (*Harris 23820*, NY, x10).

Selected Specimens Examined. ***[ACID DEFICIENT CHEMOTYPE]*** – **U.S.A. FLORIDA**. MARION CO.: Ocala National Forest, 8.xii.1987, *R.C. Harris 21101* (NY), *W.R. Buck 15454* (NY). VOLUSIA CO.: Blue Spring State Park, 23.iii.1998, *R.C. Harris 41528* (NY). **GEORGIA**. CHARLTON CO.: Stephen Foster State Park, 30.xi.2007, *S.Q. Beeching 4543* (hb. Beeching). **LOUISIANA**. ST. MARTIN PARISH.: St. Martinsville, 20.vi.1889, *A.B. Langlois s.n.* (NY). **MISSISSIPPI**. HINDS CO.: 3 mi N of Terry, 11.vi.1939, *G.T. Johnson et al. 2370* (NY).

13. *Heterodermia leucomela* (L.) Poelt

Description. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** strap–like, ascending, epruinose, marginally ciliate; **medulla** white; **underside** ecorticate, white; **rhizines** marginal, pale, simple; **soralia** terminal on the lower surface of the lobe tips; **soredia** fine, granular; **apothecia** not seen in eastern North American material.

Chemistry. – Atranorin, zeorin, salazinic acid. Spot tests: **cortex** K+ yellow, C–, KC–. P+ yellowish, UV–; **medulla** K+ yellow turning red, C–, KC–, P+ orange, UV–. Note that the underside frequently discolors yellowish orange because of the presence of salazinic acid in the medulla, and this should not be confused with the presence of a pigment as occurs in *H. appalachensis*.

Ecology and distribution. – In the study area *H. leucomela* occurs as scattered isolated populations on the bark of hardwoods in the central/southern Appalachian Mountains and Great Lakes Region (Fryday et al. 2001). Disjunct populations are also known from Florida (see discussion below). Specimens from eastern North America are not nearly as well developed as those from elsewhere in the range of *H. leucomela* such as California (see Brodo et al. 2001).

Discussion. – While *Heterodermia leucomela* is easily recognized in the field by its long ascending strap–like lobes and soralia on the undersides of the lobes, there are several problematic specimens from Florida that warrant further study. These are separated in the key but are neither included in the description above nor in the distribution map. While all specimens from the central part of its range contain salazinic acid, a disjunct population in Florida contains norstictic acid in the medulla. A further disjunct population from Florida lacks both norstictic and salazinic acid in the medulla and has marginal cilia that contain an anthraquinone pigment. Further collections from sub–tropical and tropical regions of North America are needed to determine the status of these populations.

Specimens Examined. ***[SALAZINIC ACID CHEMOTYPE]*** – **U.S.A. GEORGIA**. MURRAY CO.: Chattahoochee National Forest, 22.ix..1992, *R.C. Harris 28140* (NY). **KENTUCKY**. HARLAN CO.: Profile Rock, Kentenia State Forest, 16.ix.1991, *R.C. Harris 27156* (NY). MCCREARY CO.: Wherry's Bog, 7.viii.1941, *M.J. Allen 75* (NY). ROCKCASTLE CO.: Conway, 8.viii.1927, *B. Fink s.n.* (NY). **NEW YORK**. CATTARAUGUS CO.: Lime Lake, 1871, *G.W. Clinton s.n.* (BUF). NIAGARA CO.: Grand Island, s.d., *M.L. Wilson s.n.* (BUF). **NORTH CAROLINA**. AVERY CO.: Grandfather Mountain, vi.1936, *G.P. Anderson s.n.* (NY). BURKE CO.: Linville Falls, 14.vi.1936, *E. Harger 14* (NY). CLAY CO.: Nantahala National Forest, along Buck Creek Road, 2.x.1998, *R.C. Harris 42344* (NY). JACKSON CO.: Nantahala National Forest, S slope of Piney Ridge Knob, 7.x.1998, *R.C. Harris 42654* (NY). MACON CO.: Nantahala National Forest, Yellow Mountain Trail, 3.x.1997, *R.C. Harris 41244* (NY). TRANSYLVANIA CO.: Pisgah Forest, ix.1924, *A.T. Beals s.n.* (NY). YANCEY CO.: Pisgah National Forest, Black Mountain Campground, 14.v.1976, *W.R. Buck 1162* (NY). **OHIO**. CLARK CO.: Springfield, ~1870, *M.P. Haines s.n.* (NY). **TENNESSEE**. BLOUNT CO.: near top of Gregory's Bald, 26.v.1935, *A.J. Sharp 78* (NY). HAMILTON CO.: Lookout Mountain, i.1890, *W.W. Calkins 198* (NY). JOHNSON CO.: Cherokee National Forest, 14.vi.1964, *C.F. Reed 13796* (NY). SEVIER CO.: Gatlinburg, vi.1935, *A.J. Sharp s.n.* (NY). **VERMONT**. ADDISON CO.: Leicester, 22.iv. 1938, *D.L. Dutton 2713* (NY). **VIRGINIA**. GILES CO.: Mountain Lake Biological Station, 7.x.1995, *R.C. Harris 36753* (NY). GRAYSON CO.: Whitetop Mountain, 30.xi.1969, *C.F. Reed 106158* (NY). NORTON CO.: Norton, 1.viii.1891, *A.B. Seymour s.n.* (NY). SMYTH CO.: Sharp Top, 10.vi.1936, *G.P. Anderson s.n.* (NY). WASHINGTON CO.: Abrams Falls, 15.vi.1964, *C.F. Reed 67419* (NY). **WEST VIRGINIA**. POCAHONTAS CO.: Greenbank, iv. 1929, *F.W. Gray 11120* (NY).

Specimens Examined. *[NORSTICTIC ACID CHEMOTYPE]* – **U.S.A. FLORIDA**. GLADES CO.: Tom Gaskin's Cypress Catwalk, 30.iii.1998, *W.R. Buck 34090* (NY).

Specimens Examined. *[ACID DEFICIENT CHEMOTYPE]* – **U.S.A. FLORIDA**. COLLIER CO.: Corkscrew Swamp Sanctuary, 27.iii.1998, *R.C. Harris 41868* (NY, cilia with anthraquinone pigment). GLADES CO.: Ortona Cemetery, 30.iii.1998, *W.R. Buck 34062* (NY).

14. *Heterodermia microphylla* (Kurok.) Skorepa, Bryologist, 75: 490. 1972.

Anaptychia hypoleuca var. *microphylla* Kurok., Journ. Jap. Bot., 34(4): 123. 1959. TYPE: **JAPAN. SHINANO PROV.:** Sakakita–mura, Higashi–Cikuma–gun [sic], 28.vii.1953, on rocks, *Yamazaki s.n.* (TNS!, holotype).

Anaptychia microphylla (Kurok.) Kurok., Beihefte zur Nova Hedwigia, 6: 44. 1962.

Discussion. – Presently the name *Heterodermia microphylla* is included in the checklist of North American Lichens (Esslinger 2008) based on a report by Yoshimura and Sharp (1968). The species was not reported from the continent by Kurokawa (1959, 1962) and all subsequent reports (e.g., McCune et al. 1997) appear to be based on misidentifications of *H. hypoleuca*. This confusion is almost certainly a result of the comparisons of *H. microphylla* and *H. hypoleuca* made by Kurokawa (1959, 1962) coupled with a lack of adequate illustrations (e.g., Kurokawa 1959). *Heterodermia microphylla* is comparable in thallus/lobe morphology to *H. hypoleuca* and differs from that species in having fine marginal lobules/phyllidia like those found in *H. squamulosa*. The two species can be separated by their underside color, which is purple in *H. squamulosa* and pale white in *H. microphylla*. Chemical analysis of several specimens of *H. microphylla* from South Korea (DUKE) revealed that the species differs from *H. hypoleuca* (and *H. squamulosa*) in lacking leucotylin? and terpenoid–3 (as termed in this study).

While I have examined North American specimens identified as *H. microphylla* in two herbaria (DUKE, NY), they have all proved to be misidentifications of other taxa. I have been unable to revise the voucher on which the original report was based and thus cannot exclude the species from North America with confidence. Therefore it is included in the present treatment pending further study.

15. *Heterodermia neglecta* Lendemer, R.C. Harris, and E. Tripp

Plate 11, Figures 1,2,4,5 (page 22).

Discussion. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray or greenish blue; **lobes** plane, not ascending; lobe tips occasionally pruinose; secondary lobes short; **medulla** white, with orange pigmentation in the lower layers near the lobe tips; **underside** ecorticate, with orange pigment marginally, white becoming dirty brownish centrally as pigmented hyphae age, occasionally dark brown and almost black in the central portions of the thallus; **pigment** orange, K+ purple, concentrated near the lobe tips, often as small discrete patches; **rhizines** black, squarrose, marginal; **soralia** marginal on the lower surface of the lobe tips, often on fragile recurved secondary lobes, especially near the central portions of the thallus; **soredia** granular; **apothecia** not seen.

Chemistry. – Atranorin (cortex), zeorin (medulla), leucotylin? (medulla), norstictic acid (medulla), pigment (medulla). Spot tests: cortex, K+ yellow, C–, KC–, P+ yellowish, UV–; medulla, K+ yellow turning red, C–, KC–, P+ yellow, UV–.

Ecology and distribution. – *Heterodermia neglecta* s. str. is primarily limited to middle and high elevations of the southern Appalachians in eastern North America, where it occurs on the bark of hardwoods. Disjunct populations of the acid deficient chemotype also occur in the coastal plain of Florida, USA and coastal regions of the Canadian Maritime Provinces. A single disjunct population of the norstictic acid chemotype is known from Nova Scotia.

Discussion. – This species was recently described to accommodate material previously referred to *H. propagulifera* (see extensive discussion in Lendemer et al (2007)). While revising herbarium materials for this study it became clear that this species has been frequently misidentified, often as *H. casarettiana* and *H. japonica*. A number of specimens morphologically comparable to *H. neglecta* but differing in the absence of norstictic acid were also encountered. These are treated here as an acid deficient chemotype of *H. neglecta* because they are morphologically identical to *H. neglecta s.str.* Further study of this chemotype is warranted, especially considering that is has a wider geographic distribution seems to differ chemically and in often containing the same unknown terpenoid as *H. japonica* (see Kurokawa 1973). Based on the examination of a collection from the British Isles (West Cornwall, Isles of Scilly, 5.v.1980, *P.W. James s.n.*, NY) and the description in Purvis et al. (1992) *H. propagulifera* sensu Purvis et al. is not conspecific with *H. neglecta*.

Selected Specimens Examined. *[NORSTICTIC ACID CHEMOTYPE]* – **CANADA. NOVA SCOTIA**. LUNENBURG CO.: Beck's Lake, 29.xii.2008, *F. Anderson 14107* (NY). **U.S.A. GEORGIA**. MURRAY CO.: Chattahooche National Forest, 22.ix.1992, *R.C. Harris 28165* (NY). RABUN CO.: Chattahoochee National Forest, Rabun Bald, 4.x.1997, *R.C. Harris 41303* (NY). **NORTH CAROLINA**. MACON CO.: Nantahala National Forest, Wayah Bald, 12.x.1998, *R.C. Harris 42820* (NY); Sunset Rocks, Highlands, 9.vi.1981, *R.C. Harris 13728* (NY). JACKSON CO.: Nantahala National Forest, Panthertown Valley, 29.iv.2006, *R.C. Harris 52484* (NY). **VIRGINIA**. GILES CO.: Mountain Lake Biological Station, 24.vi.1978, *R.C. Harris 12984* (NY).

Selected Specimens Examined. *[ACID DEFICIENT CHEMOTYPE]* – **CANADA. NEW BRUNSWICK**. ALBERT CO.: Fundy National Park, 28.vi.1980, *S.P. Gowan 2853 & L. Dickson* (NY). **NOVA SCOTIA**. LUNENBURG CO.: Beck's Lake, 29.xii.2008, *F. Anderson 14106* (NY). QUEENS CO.: Thomas H. Raddall Provincial Park, 7.v.1999, *R.C. Harris 42949* (NY). **U.S.A. GEORGIA**. RABUN CO.: Lake Burton Wildlife Management Area, 17.ix.2006, *J.C. Lendemer et al. 7653* (NY). **NORTH CAROLINA**. JACKSON CO.: Nantahala National Forest, S slope of Piney Ridge Knob, 7.x.1998, *R.C. Harris 42625* (NY). MACON CO.: Wayah Bald, 26.ix.1989, *R.C. Harris 24710* (NY). **TENNESSEE**. CARTER CO.: trail down from Carvers Gap, 6.x.1985, *R.C. Harris 18352* (NY). JOHNSON CO.: Cherokee National Forest, 14.vi.1964, *C.F. Reed 137211* (NY). **VIRGINIA**. GILES CO.: Pond Drain, 7.x.1995, *R.C. Harris 36681* (NY). GRAYSON CO.: Whitetop Mt., 30.xi.1969, *C.F. Reed 106146* (NY). PICKENS CO.: along Eastatoe Creek ca. 2.5 mi SW of town of Rocky Bottom, 27.ix.1989, *R.C. Harris* 24781 (NY). WISE CO.: Jefferson National Forest, High Knob, 13.ix.1991, *R.C. Harris 26936* (NY).

16. *Heterodermia obscurata* (Nyl.) Trevis.

Plate 11, Figure 3 (page 22).

Discussion. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** plane, not ascending; epruinose; **medulla** white with orange pigment in the lower portions; **underside** ecorticate, with continuous orange pigment; **pigment** orange, K+ purple; **rhizines** black, squarrose, marginal; **soralia** marginal on the lower surface of the margins of the lobes and lobe tips, especially near the central portions of the thallus; **soredia** granular; **apothecia** not seen in eastern North American material.

Chemistry. – Atranorin, zeorin, leucotylin?, terpenoid 3, pigment. Spot tests: **cortex** K+ yellow, C, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

Ecology and distribution. – In eastern North America, *H. obscurata* is widely distributed in the piedmont, coastal plain, and low to middle elevations of the Appalachian Mountains, with populations extending into the Ozark Ecoregion and Great Lakes Region. At middle to high elevations of the southern Appalachians, the species seems to be replaced by *H. neglecta*.

Discussion. – After revision of the substantial holdings of *H. obscurata* at NY, it has become clear that this species is remarkably rare at middle to high elevations of the Appalachian Mountains, only being known from a handful of collections. In that region, it is sympatric with *H. neglecta*, which differs in overall morphology (Lendemer et al. 2007) and in having the pigment concentrated near the lobe tips rather than deposited evenly across the lower surface of the thallus. Apparently, *H. obscurata* is primarily a species of the coastal plain, piedmont, and low elevations of the Appalachian Mountains in eastern North America. Specimens of *H. obscurata* are easily recognized in the field by the entirely brownish–orange lower surface. In eastern North America this character is shared only with *H. casarettiana* which has a different pigment (K–) and norstictic acid in the medulla. *Heterodermia casarettiana* is typically a saxicolous speciesn while *H. obscurata* is typically corticolous.

Based on the examination of a collection identified as *H. obscurata* from the British Isles (West Cornwall, Isles of Scilly, 5.v.1980, *P.W. James s.n.;* NY) *H. obscurata* sensu Purvis et al. (1992) is not conspecific with *H. obscurata*. Rather, the British concept of *H. obscurata* seems to correspond to *H. neglecta*.

Specimens Examined. – **U.S.A. ALABAMA**. BIBB CO.: Talladega National Forest, 1.x.1992, *R.C. Harris 28911* (NY). CALHOUN CO.: Fort McClellan, 26.i.1977, *E.G. Worthley s.n.* (NY). **ARKANSAS**. IZARD CO.: Franklin, ix.1950, *A. Robinson 4* (NY). FRANKLIN CO.: Ozark National Forest, Spy Rock Hollow, 8.vi.2000, *W.R. Buck 37231* (NY). GARLAND CO.: 6 mi from Hot Springs, *sine legit 1455* (NY). JEFFERSON CO.: Pine Bluff Arsenal, 2.xii.1999, *D. Ladd 21970* (NY). JOHNSON CO.: Ozark National Forest, Katie Knob, 17.iv.2004, *R.C. Harris 49330* (NY). MADISON CO.: Madison County Wildlife Management Area, 2.xi.2000, *R.C. Harris 44651* (NY). POPE CO.: Ozark

National Forest, Cowan Hollow, 7.xi.2002, *R.C. Harris 46905* (NY). SEARCY CO.: Buffalo National River, 18.iv. 2005, *R.C. Harris 51150* (NY). SHARP CO.: Strawberry River Preserve, 25.x.2001, *R.C. Harris 45538* (NY). STONE CO.: Cherokee Wildlife Management Area, 24.x.2001, *R.C. Harris 45471* (NY). **FLORIDA**. BAY CO.: N of Co. Rd. 388, 1.xii.1994, *R.C. Harris 35706* (NY). BREVARD CO.: Corner of Fox Lake Road and South Carpenter Road, 7.i. 1996, *R.C. Harris 37433* (NY). CALHOUN CO.: along S side of Fla Hwy 20, 30.xi.1988, *R.C. Harris 23049–A* (NY). CLAY CO.: Goldhead Branch State Park, 24.vi.1973, *W.R. Buck s.n.* (NY). COLUMBIA CO.: Osceola National Forest, 15.xii.1993, *R.C. Harris 32549–B* (NY). DIXIE CO.: Steinhatchee Wildlife Management Area, 4.xii.1993, *R.C. Harris 31633* (NY). GLADES CO.: Ortona Cemetery, 30.iii.1998, *W.R. Buck 34043* (NY). HAMILTON CO.: Bee Haven Bay, 15.xii.1993, *R.C. Harris 32507* (NY). HIGHLANDS CO.: Hickory Hammock, 28.iii.1998, *R.C. Harris 41936–A* (NY). JEFFERSON CO.: Monticello, 13.iii.1891, *H.L. Lighthife s.n.* (NY). LAKE CO.: Eustis, 16–30.vi. 1895, *G.V. Nash 2036* (NY). LEVY CO.: Cedar Key Scrub State Preserve, 30.xi.1992, *R.C. Harris 29322* (NY). MADISON CO.: E of Co. Rd. 150, 14.xii.1993, *R.C. Harris 32416* (NY). MANATEE CO.: Duette Park, 29.iii.1998, *R.C. Harris 42075–K* (N). MARION CO.: Juniper Springs, 3.ii.1962, *P.O. Schallert L263* (NY). MARTIN CO.: Jonathan Dickinson State Park, 25.iii.1998, *R.C. Harris 41689* (NY). OKALOOSA CO.: ~4 mi S of Crestview, 5.v. 1990, *R.C. Harris 25210* (NY). POLK CO.: Fedhaven, 19.i.1989, *E.M. Wheeler s.n.* (NY). TAYLOR CO.: Along C.R. 361, 3.xii.1996, *R.C. Harris 39549* (NY). VOLUSIA CO.: South Tomoka Wildlife Management Area, 6.i.1996, *R.C. Harris 37335* (NY). WASHINGTON CO.: Rock Hill, 30.xii.1994, *R.C. Harris 35591* (NY). **GEORGIA**. APPLING CO.: Along Co. Rd. 431, 19.iii.1995, *R.C. Harris 36401* (NY). CLARKE CO.: East Athens, 2.x.1992, *R.C. Harris 28922* (NY). COFFEE CO.: Broxton Rocks Ecological Preserve, 18.ix.1996, *R.C. Harris 38815* (NY). COLUMBIA CO.: Heggie's Rock Preserve, 6.x.1999, *R.C. Harris 43519* (NY). GREENE CO.: Oconee National Forest, 19.ix.1996, *R.C. Harris 38891* (NY). GWINNETT CO.: Tribble Mill Park, 10.vi.2008, *S.Q. Beeching 6116* (hb. Beeching). JEFF DAVIS CO.: 0.4 mi E of Coffee County line, 18.ix.1996, *R.C. Harris 38784* (NY). LAURENS CO.: Laurens County Public Fishing Area, 8.x.1999, *R.C. Harris 43602* (NY). MURRAY CO.: Chattahoochee National Forest, Cohutta Wilderness, 22.ix.1992, *R.C. Harris 28119* (NY). PUTNAM CO.: Eatonton Granite Outcrop, 8.x.1999, *R.C. Harris 43692* (NY). UNION CO.: Chattahoochee National Forest, along Duncan Ridge Trail, 6.x.1998, *R.C. Harris 42520* (NY). RABUN CO.: Lake Burton Wildlife Management Area, 17.ix.2006, *J.C. Lendemer et al. 7966* (NY). **ILLINOIS**. POPE CO.: Shawnee National Forest, 16.x.1993, *R.C. Harris 31377* (NY). **KENTUCKY**. BATH CO.: Daniel Boone National Forest, 10.x.1995, *R.C. Harris 36904* (NY). BULLITT CO.: Bernheim Arboretum and Research Forest, 26.iii.2002, *D. Ladd 23531* (NY). LETCHER CO.: Bad Branch Nature Preserve, 14.ix.1991, *R.C. Harris 27091* (NY). **LOUISIANA**. EAST FELICIANA PARISH.: Idlewild Experimental farm, 16.iii.1979, *S.C. Tucker 18421* (NY). NATCHITOCHES PARISH.: Kisatchie National Forest, 27.iii.1982, *J. Pruski 2482* (NY). **MARYLAND**. BALTIMORE CO.: Gunpowder State Park, 2.i.1985, *E.G. Worthley L–244* (NY). CAROLINE CO.: Idylwild State Wildlife Management Area, 18.iv.2006, *J.C. Lendemer 6253 & W. Knapp* (NY). MONTGOMERY CO.: just S of Dawsonville, 19.iv.1962, *C.F. Reed 55782* (NY). **MICHIGAN**. WASHTENAW CO.: Waterloo Recreation Area, 28.ix.1974, *W.R. Buck s.n.* (NY). **MISSISSIPPI**. JASPER CO.: Bienville National Forest, 30.ix.1992, *R.C. Harris 28874* (NY). HINDS CO.: 3 mi N of Terry, 11.vi.1939, *G.T. Johnson 2369 & H.N. Andrews* (NY). JACKSON CO.: 2 mi N of Vancleave, 15.vi.1939, *G.T. Johnson 3015* (NY). SCOTT CO.: Bienville National Forest, 29.ix.1992, *R.C. Harris 28742* (NY). SHARKEY CO.: Delta National Forest, vii.1978, *G.T. Johnson s.n.* (NY). TISHOMINGO CO.: Tishomingo State Park, 27.ix.1992, *R.C. Harris 28596* (NY). WINSTON CO.: Tombigbee National Forest, 28.ix. 1992, *R.C. Harris 28691* (NY). **MISSOURI**. CARTER CO.: Ozark National Scenic Riverways, Big Sping area, 23.ix. 1990, *R.C. Harris 25719* (NY). DOUGLAS CO.: Rippee Conservation Area, 19.v.2003, *R.C. Harris 47367* (NY). GREENE CO.: Rocky Barrens Conservation Area, 16.iv.2005, *R.C. Harris 50939* (NY). HOWELL CO.: White Ranch Conservation Area, 10.vi.2000, *W.R. Buck 37518* (NY). IRON CO.: St. Francis Mountains, 13.x.1993, *R.C. Harris 31198* (NY). LACLEDE CO.: Bear Creek Conservation Area, 4.xi.2002, *R.C. Harris 46619* (NY). MADISON CO.: Amidon Memorial Conservation Area, 21.x.2001, *R.C. Harris 45039–A* (NY). OREGON CO.: Mark Twain National Forest, Falling Spring, 17.iv.1997, *R.C. Harris 40487* (NY). OZARK CO.: Mark Twain National Forest, 18.iv.1997, *R.C. Harris 40641* (NY). PHELPS CO.: Mark Twain National Forest, Roluf Spring Woodland Restoration Area, 11.ix. 1993, *D. Ladd et al. 17367–B* (NY). SHANNON CO.: Angeline Conservation Area, 19.iv.2005, *R.C. Harris 51268* (NY). STE. GENEVIEVE CO.: Pickle Springs Natural Area, 26.ix.1990, *R.C. Harris 26004* (NY). TANEY CO.: Mark Twain National Forest, 22.v.2003, *R.C. Harris 47768–A* (NY). TEXAS CO.: Gist Ranch Conservation Area, 4.xi.2004, *R.C. Harris 50325–A* (NY). WASHINGTON CO.: Hughes Mountain Conservation Area, 3.xi.2002, *R.C. Harris 46450* (NY). WAYNE CO.: Coldwater Conservation Area, 22.x.2001, *R.C. Harris 45123* (NY). **NEW JERSEY**. BERGEN CO.: Closter, *C.F. Austin s.n.* (NY). BURLINGTON CO.: Wharton State Forest, ca. 1 mile west of Atsion, 4.vi.2005, *J.C. Lendemer et al. 4291* (NY). **NEW YORK**. SUFFOLK CO.: Orient, 1914, *G. Nearing s.n.* (NY). **NORTH CAROLINA**. ALAMANCE CO.: Rte 54 near Alamance/Orange Co. line, vi.1936, *G.P. Anderson s.n.* (NY). AVERY CO.: Linville Gorge, 1924, *A.T. Beals s.n.* (NY). DURHAM CO.: Duke Forest, 3.iii.1967, *S.B. Pravda s.n.* (NY). JACKSON CO.: Nantahala National Forest, Cattooga Wild and Scenic River / Ellicott Rock Wilderness, 18.ix.2006, *J.C. Lendemer et al. 7864* (NY). MACON CO.: Sunset Rock, 9.vi.1981, *R.C. Harris 13682* (NY). MADISON CO.: Blue Ridge Parkway, 1 mi N of Big Laurel Gap, 6.v.1967, *S.B. Pravda s.n.* (NY). WILKES CO.: Stone Mountain State Park, 23.ix.1993, *R.C. Harris 30796* (NY). **OHIO**. ADAMS CO.: Appalachia Nature Preserve, 20.v.2006, *R.C. Harris 52708* (NY). **OKLAHOMA**. ADAIR CO.: Cookson Hills Wildlife Management Area, 1.xi.2000, *R.C. Harris 44464* (NY). CHEROKEE CO.: Cookson Wildlife Management Area, 14.iv.2004, *R.C. Harris 49023* (NY).

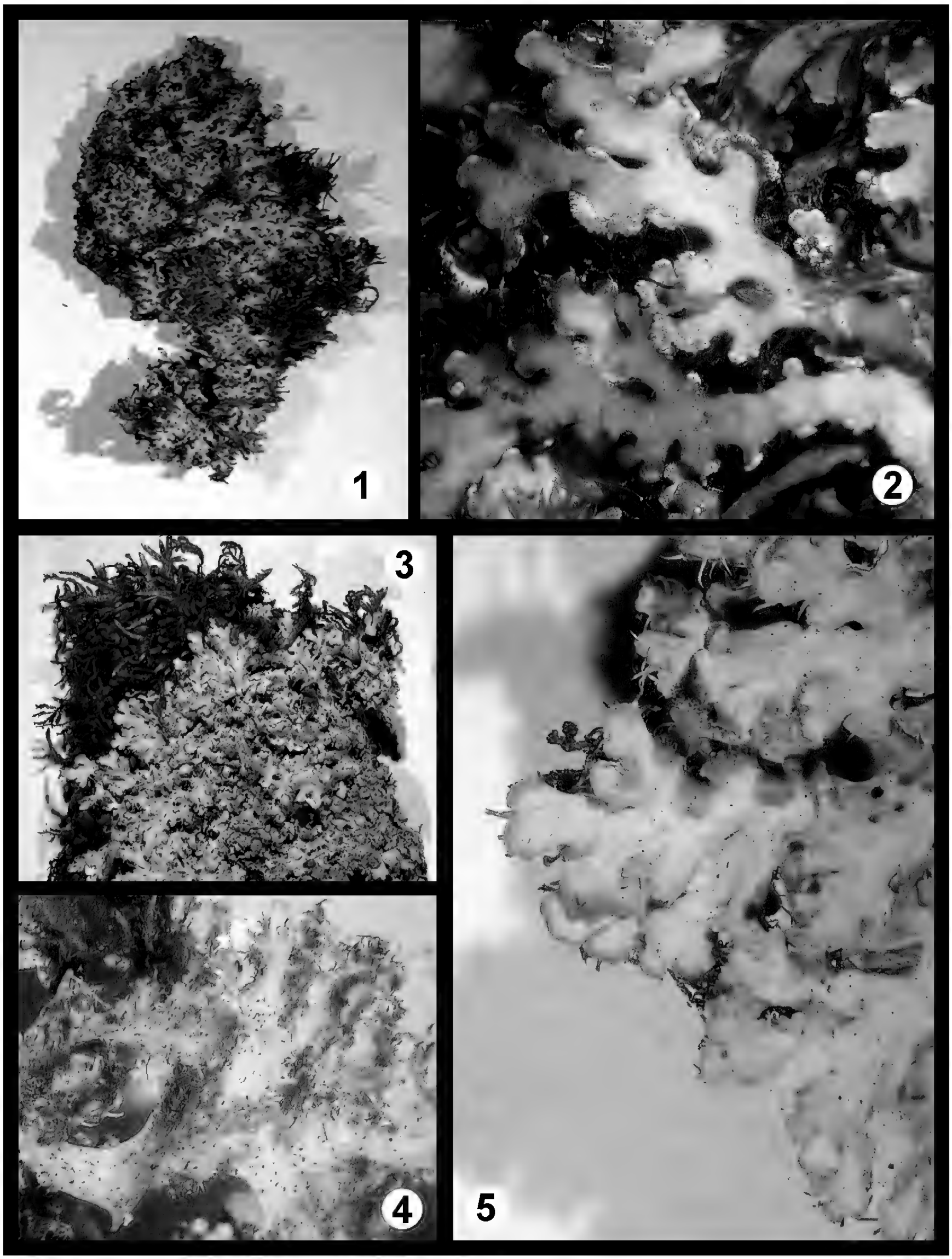

Plate 12. Figures 1–2, *Heterodermia pseudospeciosa* (*Lendemer 7395*, NY). Figure 1, thallus. Figure 2, detail of lobes and soralia (x10). Figures 3–5, *H. speciosa*. Figure 3, thallus (*Harris 53446*, NY). Figure 4, underside of lobe (*Lendemer 8627*, NY, x10). Figure 5, detail of thallus margin (*Lendemer 8627*, NY, x10).

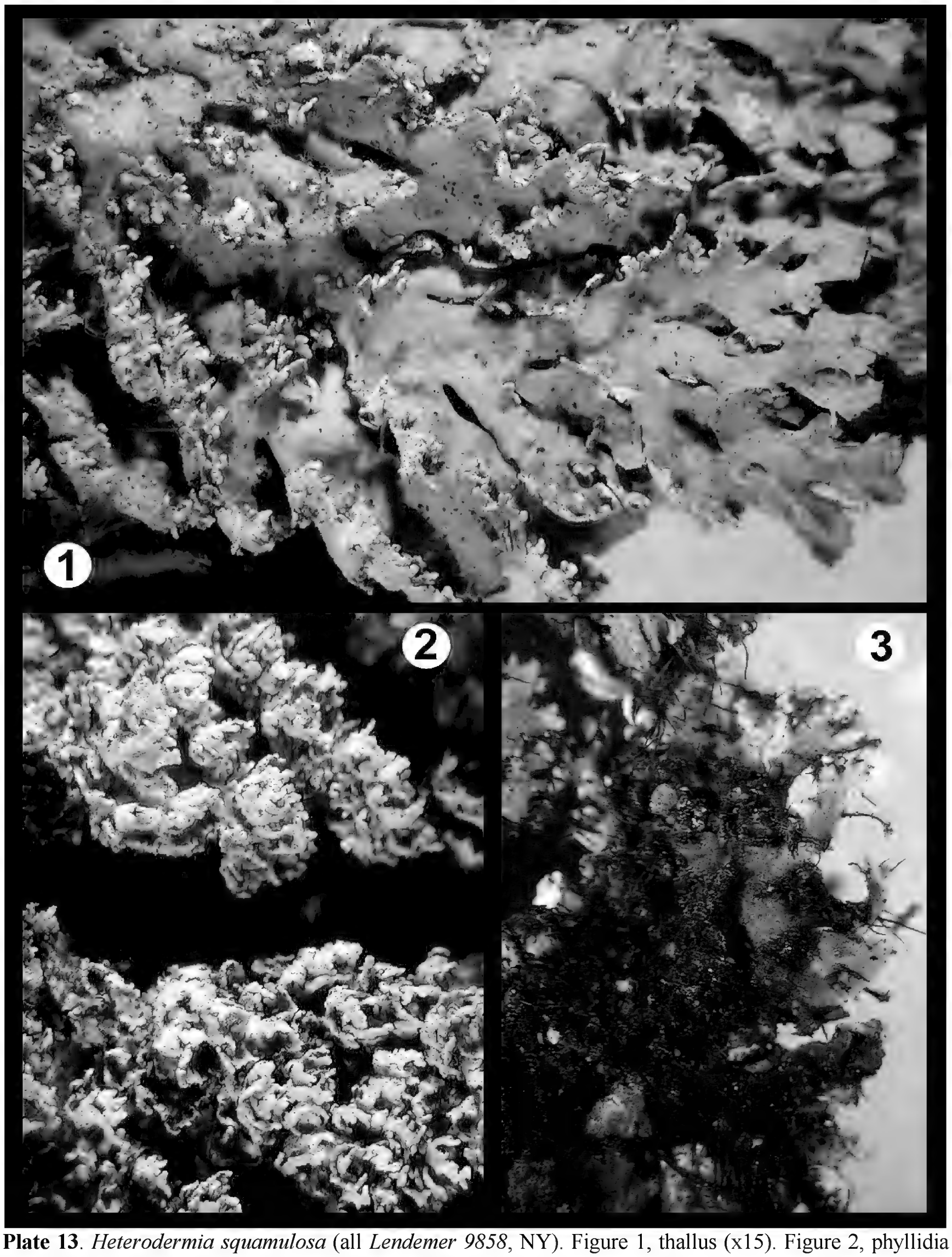

Plate 13. *Heterodermia squamulosa* (all *Lendemer 9858*, NY). Figure 1, thallus (x15). Figure 2, phyllidia (x10). Figure 3, lower surface with purple pigmentation (x10).

PENNSYLVANIA. PIKE CO.: Delaware Water Gap National Recreation Area, 18.ix.2005, *J.C. Lendemer et al. 5039* (NY). **SOUTH CAROLINA**. NEWBERRY CO.: Sumter National Forest, 15.iii.1997, *R.C. Harris 40107* (NY). PICKENS CO.: ~2.5 mi SW of Rocky Bottom, 27.ix.1989, *R.C. Harris 24736* (NY). RICHLAND CO.: Fort Jackson Army Base, 13.iii.1997, *R.C. Harris 39981* (NY). **TENNESSEE**. CARTER CO.: Doe River Gorge, 26.ix.1993, *R.C. Harris 31002* (NY). HICKMAN CO.: Middle Tennessee State University Wildlife Management Area, 10.viii.1997, *L.R. Phillippe 29230 & R. Barbour* (NY). JOHNSON CO.: Iron Mountain summit, 14.vi.1964, *.C.F Reed 137215* (NY). **TEXAS**. BREWSTER CO.: Big Bend National Park, 5.vi.1959, *R.A. Anderson & S. Shushan L–18682 = Lich. Exs. COLO 684* (NY). **VIRGINIA**. ACCOMACK CO.: Along US Hwy. 13, between Oak Hall and New Church, vi. 1936, *G.P. Anderson s.n.* (NY). GILES CO.: Jefferson National Forest, 8.x.1995, *R.C. Harris 36772* (NY). HANOVER CO.: Green Bay, 9.x.1964, *C.F. Reed 68548* (NY). PRINCE GORGE CO.: N of Carson, 1.iv.1964, *C.F. Reed 68625* (NY). SCOTT CO.: Hintons, 15.vi.1964, *C.F. Reed 67678–A* (NY). SPOTSYLVANIA CO.: S of Snell, 9.x.1964, *C.F. Reed 68490* (NY).

17. *Heterodermia podocarpa* (Bél.) Awasthi

Discussion. – See discussion under *H. barbifera* for notes on the occurrence of this species in the study area, and the usage of this name on the North American checklist (Esslinger 2008).

18. *Heterodermia pseudospeciosa* (Kurok.) W.L. Culb.

Plate 12, Figures 1 & 2 (page 27).

Discussion. – **Thallus** foliose, sorediate, diminutive; **upper surface** gray to blue–gray, often darkened to brownish; **lobes** plane, not ascending, epruinose; **medulla** white; **underside** corticate, pale to light brown centrally; **rhizines** pale, squarrose, marginal and laminal; **soralia** marginal on the lower surface of the margins of the lobes and tips of secondary lobes, especially near the central portions of the thallus; **soredia** fine, granulose; **apothecia** not seen in eastern North American material.

Chemistry. – Atranorin, zeorin, leucotylin(?), norstictic acid. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K+ yellow turning red, C–, KC–, P+ yellow, UV–.

Ecology and distribution. – *Heterodermia pseudospeciosa* is a rare taxon restricted to rocks and boulders of humid localities of the southern/central Appalachian Mountains in eastern North America (see Culberson 1966).

Discussion. – While some authors may consider *H. pseudospeciosa* to represent a chemotype of *H. speciosa*, I follow Kurokawa (1962) and Moberg and Nash (2002) in recognizing it as a distinct taxon. Morphologically, the species is consistently smaller than *H. speciosa* and the soralia are borne on small secondary knob–like lobes along the margins of the primary lobes. The species is also ecologically distinctive in that it almost always occurs on rocks in humid habitats (Culberson 1966, Moberg & Nash 2002). As a result of the positive medullary reaction with KOH, the species could be confused with *H. albicans*, however *H. albicans* has a different distribution in eastern North America and usually has a larger thallus with continuous marginal soralia.

Selected Specimens Examined. – **U.S.A. NORTH CAROLINA**. JACKSON CO.: Nantahala National Forest, trail from Whitewater Falls overlook, 14.ix.1996, *R.C. Harris 38612* (NY). MACON CO.: Nantahala National Forest, McDowell Mountain, 12.viii.1994, *R.C. Harris 33139* (NY). **OHIO**. GALLIA CO.: Wayne National Forest, above Symmes Creek, 19.v.2006, *J.C. Lendemer et al. 7395* (NY, PH).

19. *Heterodermia speciosa* (Wulfen) Trevis.

Plate 12, Figures 3-5 (page 27).

Discussion. – **Thallus** foliose, sorediate; **upper surface** gray to blue–gray; **lobes** plane, not ascending; epruinose; **medulla** white; **underside** corticate, pale to light brown centrally; **rhizines** pale, squarrose, marginal and laminal; **soralia** marginal on the lower surface of the margins, especially near the central portions of the thallus; **soredia** coarse, granulose; **apothecia** not seen in eastern North American material.

CHEMISTRY. – Atranorin, zeorin, terpenoid–2. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

ECOLOGY AND DISTRIBUTION. – This taxon is common throughout eastern North America, except in the sub–tropical regions of the coastal plain. It is most often found on the bark of hardwoods, but occasionally also occurs on rocks.

DISCUSSION. – Without a doubt *Heterodermia speciosa* is the most common and widespread species of the genus in eastern North America. Interestingly, based on the material examined, it is almost absent from the coastal plain in southeastern North America where it is replaced by another large sorediate species, *H. albicans*. The degree to which the lower surface is corticate is highly variable, and care should be taken not to confuse this common species with any of the rare species which are outwardly similar to *H. speciosa* but have an ecorticate lower surface (e.g., *H. erecta, H. galactophylla, H. japonica*).

SELECTED SPECIMENS EXAMINED. – **CANADA. ONTARIO**. Thunder Bay District, 11.x.1986, *C.E. Garton 23573* (NY). **NOVA SCOTIA**. COLCHESTER CO.: Economy River Wilderness Area, 17.v.2004, *R.C. Harris 49917* (NY). CUMBERLAND CO.: Cape Chignecto Provincial Park, 15.v.2004, *R.C. Harris 49804* (NY). LUNENBURG CO.: Beck's Lake, 29.xii.2008, *F. Anderson 14109* (NY). **U.S.A. ALABAMA**. CALHOUN CO.: Fort McClellan, 26.i.1977, *E.G. Worthley s.n.* (NY). COVINGTON CO.: Conecuh National Forest, 14.iv.2007, *J.C. Lendemer et al. 9441* (NY). JACKSON CO.: Buck's Pocket State Park, 3.x.1998, *W.R. Buck 42358* (NY). WINSTON CO.: Bankhead National Forest, 25.ix.1992, *R.C. Harris 28442* (NY). **ARKANSAS**. BENTON CO.: Hobbs State Park–Conservation Area, 16.x.2005, *J.C. Lendemer et al. 5137* (NY). CONWAY CO.: Ozark National Forest, 8.xi.2002, *R.C. Harris 46965–A* (NY). CRAWFORD CO.: Ozark National Forest, 15.iv.2004, *R.C. Harris 49168* (NY). MARION CO.: vicinity of Crooked Creek, 25.iv.1988, *R.C. Harris 21562* (NY). NEWTON CO.: Ozark National Forest, 28.iii.2006, *R.C. Harris 52248* (NY). SEARCY CO.: Buffalo National River, 17.iv.2005, *R.C. Harris 51041* (NY). SHARP CO.: Harold E. Alexander Wildlife Management Area, 25.x.2001, *R.C. Harris 45627* (NY). **CONNECTICUT**. LITCHFIELD CO.: town of North Canaan, 21.ix.2003, *R.C. Harris 48087* (NY). **DELAWARE**. NEW CASTLE CO.: Wilmington, 4.v. 1891, *A. Commons s.n.* (NY). **FLORIDA**. MARION CO.: Ocala National Forest, 7.xii.1988, *W.R. Buck 16836* (NY). SANTA ROSA CO.: Blackwater River State Forest, 9.xii.1993, *R.C. Harris 32080* (NY). TAYLOR CO.: Aucilla Wildlife Management Area, 12.xii.1993, *R.C. Harris 32236* (NY). **GEORGIA**. MADISON CO.: Broad River Natural Area, 29.vii.2006, *S.Q. Beeching 1682* (NY, hb. Beeching). MURRAY CO.: Chattahoochee National Forest, 22.ix. 1992, *R.C. Harris 28172* (NY). TOWNS CO.: Southern Nantahala Wilderness, 11.xi.2007, *J.C. Lendemer et al. 10920* (NY). **ILLINOIS**. COLES CO.: Lakeview Park, 4.ix.1986, *T. Motley 6* (NY). **INDIANA**. BROWN CO.: Yellowwood State Park, 18.xi.2007, *L.B. Sparrius 9117* (NY). PUTNAM CO.: 2 mi NW of Greencastle, 8.v.1945, *K.A. Wagner 399* (NY). **IOWA**. EMMET CO.: Estherville, 11.iii.1927, *B.O. Wolden 107* (NY). FAYETTE CO.: Fayette, vii.1894, *B. Fink s.n.* (NY). **KENTUCKY**. BULLITT CO.: Bernheim Arboretum and Research Forest, 25.iii.2002, *D. Ladd 23366* (NY). GRAYSON CO.: Rt. 259, 2 mi N of Leitchfield, 14.vii.1973, *C.F. Reed 95089* (NY). MUHLENBERG CO.: 1 mi W of Rochester, 17.vi.1962, *C.F. Reed 57662* (NY). ROWAN CO.: Lochege, 1.xi.1947, *C.F. Reed 14352* (NY). SIMPSON CO.: Hickory Falls to Rapids, 16.vi.1953, *C.F. Reed 58016–D* (NY). **MAINE**. AROOSTOOK CO.: Pettiquaggamas Lake, 8.viii.1893, *C.E. Cummins & E.A. Teller s.n.* (NY). **MARYLAND**. ANNE ARUNDEL CO.: near Glenburnie, 22.i.1910, *C.C. Plitt s.n.* (NY). GARRETT CO.: 2 mi S of Redhouse, 24.vi.1962, *C.F. Reed 54445* (NY). TALBOT CO.: Chancellor Point, 12.vi.1963, *C.F. Reed 61771–A* (NY). **MASSACHUSETTS**. BERKSHIRE CO.: town of Florida, 7.v.1995, *R.C. Harris 36554* (NY). BRISTOL CO.: New Bedford, s.d., *H. Willey s.n.* (NY). **MICHIGAN**. EMMET CO.: S of Lark's Lake, 1.vii.1974, *W.R. Buck s.n.* (NY). JACKSON CO.: E of Race Rd., 9.xi. 1974, *R.C. Harris 9751* (NY). **MINNESOTA**. CLEARWATER CO.: Lake Itasca, 22.vii.1981, *D.H. Vitt 26646* (NY). KOOCHICHING CO.: Voyageurs National Park, 20.vi.1979, *C.M. Wetmore 37904* (NY). **MISSOURI**. BARRY CO.: Mark Twain National Forest, 27.iii.2006, *J.C. Lendemer et al. 6473* (NY). CRAWFORD CO.: Onondaga Cave State Park, 2.xi.2004, *R.C. Harris 50102* (NY). DENT CO.: Indian Trail Conservation Area, 3.xi.2004, *R.C. Harris 50150* (NY). JEFFERSON CO.: Don Robinson Property, 24.iii.2006, *J.C. Lendemer et al. 5973* (NY). LACLEDE CO.: Bear Creek Conservation Area, 4.xi.2002, *R.C. Harris 46609* (NY). OZARK CO.: Mark Twain National Forest, 19.v.2003, *A. Amtoft 1028* (NY). SHANNON CO.: Angeline Conservation Area, 19.iv.2005, *R.C. Harris 51253* (NY). TEXAS CO.: Barn Hollow Natural Area, 4.xi.2004, *R.C. Harris 50348* (NY). WASHINGTON CO.: Hughes Mountain Conservation Area, 3.xi.2002, *A. Amtoft 311* (NY). WAYNE CO.: Flatwoods Conservation Area, 15.x.2003, *R.C. Harris 48484* (NY). **NEW HAMPSHIRE**. Mt. Moosilauke, 10.vii.1891, *C.E. Cummings s.n.* (NY). **NEW JERSEY**. BURLINGTON CO.: Rutgers University Pinelands Field Station, 3.ii.2005, *J.C. Lendemer 3874* (NY). HUNTERDON CO.: Mitchell Property, 4.xi.1992, *R.C. Harris 29021* (NY). SUSSEX CO.: Andover, s.d., *G.P. Anderson s.n.* (NY). WARRN CO.: Presbyterian Camp, 13.ix.1992, *R.C. Harris 27990* (NY). **NEW YORK**. CATTARAUGUS CO.: Lime Lake, viii.1871, *G.W. Clinton s.n.* (BUF). CLINTON CO.: town of Black Brook, 21.x.1996, *R.C. Harris 39261* (NY). ERIE CO.: Buffalo, 1870, *M.L. Wilson s.n.* (BUF). ESSEX CO.: Moxham Pond Fen, 19.ix.1993, *R.C. Harris 30672* (NY). **NORTH CAROLINA**. ALLEGANY CO.: N of Sparta, 13.vi.1964, *C.F. Reed 138203* (NY). CLAY CO.: Nanthala National Forest, Buck Creek Barren, 19.xi.2007, *J.C. Lendemer et al. 10761* (NY). HAYWOOD CO.: Great Smoky Mountains National Park, 3 mi SE of Waterville, 28.x.2006, *J.C. Lendemer 8194 & E. Tripp* (NY). ORANGE

CO.: Mason Farm Biological Preserve, 13.iv.2007, *G.B. Perlmutter et al. 909* (NY). TRANSYLVANIA CO.: Gorges State Park, 9.viii.2005, *J.C. Lendemer 4599 & E. Tripp* (NY). **OHIO**. ADAMS CO.: Appalachia Nature Preserve, 20.v. 2006, *R.C. Harris 52708–A* (NY). SCIOTO CO.: Shawnee State Forest, 21.v.2006, *J.C. Lendemer et al. 7160* (NY). **OKLAHOMA**. CHEROKEE CO.: Cookson Wildlife Management Area, 14.iv.2004, *R.C. Harris 49025* (NY). SEQUOYAH CO.: Sallisaw–Brushy Lake State Park, 1.xi.2000, *R.C. Harris 44555* (NY). **PENNSYLVANIA**. COLUMBIA CO.: State Game Lands No. 58, 23.iv.2008, *J.C. Lendemer et al. 11899* (NY). DAUPHIN CO.: State Game Lands No. 210, 10.iii.2007, *J.C. Lendemer 8627 & J. Stabley* (NY). HUNTINGDON CO.: Trough Creek State Park, 22.iv.2008, *J.C. Lendemer et al. 11822* (NY). LANCASTER CO.: Conewago, 25.ii.1892, *A.A. Heller s.n.* (NY). PERRY CO.: Mahany Ridge, 28.iii.1970, *C.F. Reed 85640* (NY). PIKE CO.: Porter Township, 20.iv.2008, *W.R. Buck 53446* (NY). **SOUTH CAROLINA**. OCONEE CO.: Rt. 76 at Chattooga River, 28.xi.1969, *C.F. Reed 87964* (NY). **TENNESSEE**. MONROE CO.: Cherokee National Forest, 6.viii.1994, *R.C. Harris 32919* (NY). PICKETT CO.: 1 mi S of Kentucky State Lake, 15.vi.1962, *C.F. Reed 58373* (NY). **VERMONT**. RUTLAND CO.: Pawlet, 19.ix.1922, *W.R. Taylor 171* (NY). **VIRGINIA**. CAROLINE CO.: near Chilesburg, 13.vi.1963, *C.F. Reed 62318* (NY). DINWIDDIE CO.: 1.5 mi NW of Sutherland, 14.vi.1963, *C.F. Reed 63177–A* (NY). ESSEX CO.: near Montague, 7.iii. 1964, *C.F. Reed 137637* (NY). HENRICO CO.: near Seven Pines, 25.i.1963, *C.F. Reed 60686* (NY). NELSON CO.: Climax Quarry, 11.iv.1969, *C.F. Reed 84685* (NY). PATRICK CO.: 2 mi NE of Farrystone Park, 25.vi.1968, *C.F. Reed 129018* (NY). RICHMOND CO.: 1–2 mi SW of Warsaw, 15.iv.1963, *C.F. Reed 61857* (NY). SCOTT CO.: at Hintons, 15.vi.1964, *C.F. Reed 67689* (NY). **WEST VIRGINIA**. POCAHONTAS CO.: Watoga State Park, 1.x.2000, *R.C. Harris 43996* (NY). **WISCONSIN**. SAUK CO.: Baraboo Hills, 4.ix.1998, *R.C. Harris 42119* (NY). VILAS CO.: town of Arbor Vitae, 28.iv.2002, *W.R. Buck 41691* (NY).

20. *Heterodermia squamulosa* (Degel.) Culb.

Plate 13 (page 28).

Discussion. – **Thallus** foliose, lobulate/phyllidiate; **upper surface** gray to blue–gray; **lobes** plane, not ascending; epruinose; **medulla** white; **underside** ecorticate, purple pigmented centrally; **rhizines** dark, squarrose, marginal; **lobules** fine and weakly corticate, often disintegrating and giving the appearance of coarse soredia or isidia, marginal, especially near the central portions of the thallus; **apothecia** not seen.

Chemistry. – Atranorin, zeorin, terpenoid 2, terpenoid 3. Spot tests: **cortex** K+ yellow, C–, KC–, P+ yellowish, UV–; **medulla** K–, C–, KC–, P–, UV–.

Ecology and distribution. – *Heterodermia squamulosa* is restricted primarily to the central and southern Appalachian Mountains where it occurs on the bark of hardwoods. Disjunct populations occur in Nova Scotia.

Discussion. – *Heterodermia squamulosa* is the only lobulate/phyllidiate species of *Heterodermia* that occurs in eastern North America (but see *H .microphylla* above). It is most likely to be confused with *H. microphylla*, which apparently differs in having an entirely pale lower surface and in having a thallus morphology comparable to *H. hypoleuca*. The asexual propagules of *H. squamulosa* are remarkably variable marginal phyllidia that frequently disintegrate giving the appearance of coarse soredia or isidia. In such thalli, care should be taken to search for well developed phyllidia as they are frequently present on at least some portion of the thallus. Fortunately, the ecorticate underside which is purple pigmented and the terpenoid profile are sufficiently distinctive that they can be used to recognize problematic specimens.

Selected Specimens Examined. – **CANADA. NOVA SCOTIA**. LUNENBURG CO.: Beck's Lake, 29.xii.2008, *F. Anderson 14103* (NY); behind Crouse's Settlement, 16.ii.2008, *F. Anderson 1343* (NY). **U.S.A. GEORGIA**. MURRAY CO.: Chattahooche National Forest, Cohutta Wilderness, 22.ix.1992, *R.C. Harris 28186* (NY). RABUN CO.: Chattahooche National Forest, Rabun Bald, 20.ix.1996, *R.C. Harris 38972* (NY). TOWNS CO.: Southern Nantahala Wilderness, 11.xi.2007, *J.C. Lendemer et al. 10915* (NY). UNION CO.: Chattahooche National Forest, along Duncan Ridge Trail, 6.x.1998, *R.C. Harris 42562* (NY). **KENTUCKY**. WOLFE CO.: Pine Ridge to Sky Bridge, 1.v.1961, *C.F. Reed 118798* (NY). **NORTH CAROLINA**. AVERY CO.: Linville, 13–15.vi.1936, *G.P. Anderson s.n.* (NY). CLAY CO.: Nantahala National Forest, Buck Creek Barrens, 10.xi.2007, *J.C. Lendemer et al. 10861* (NY). JACKSON CO.: Nantahala National Forest, S slope of Piney Ridge Knob, 7.x.1998, *W.R. Buck 34973* (NY). MACON CO.: near Standing Indian Campground, 24.iv.1982, *C.F. Reed 121333* (NY). TRANSYLVANIA CO.: Pisgah Forest, ix.1924, *A.T. Beals s.n.* (NY). **TENNESSEE**. JOHNSON CO.: Cherokee National Forest, 14.vi.1964, *C.F. Reed 137187* (NY). SEVIER CO.: LeConte Trail from Newfound Gap, vi.1935, *A.J. Sharp s.n.* (NY). **VIRGINIA**. BEDFORD CO.: Apple Orchard Mountain, 25.ii.1982, *C.F. Reed 127895* (NY). GILES CO.: Jefferson National Forest, Mountain Lake Wilderness Area, 8.x.1995, *R.C. Harris 36748* (NY). GRAYSON CO.: Whitetop Mountain, 30.xi. 1969, *C.F. Reed 106156* (NY). WISE CO.: High Knob, 18.ix.1991, *R.C. Harris 26956* (NY). **WEST VIRGINIA**. BARBOUR CO.: Audra State Park, 24.xi.1985, *L.R. Phillippe 3374* (NY). POCAHONTAS CO.: Watoga State Park, 21.x.2007, *J.C. Lendemer 9838 & A. Moroz* (NY).

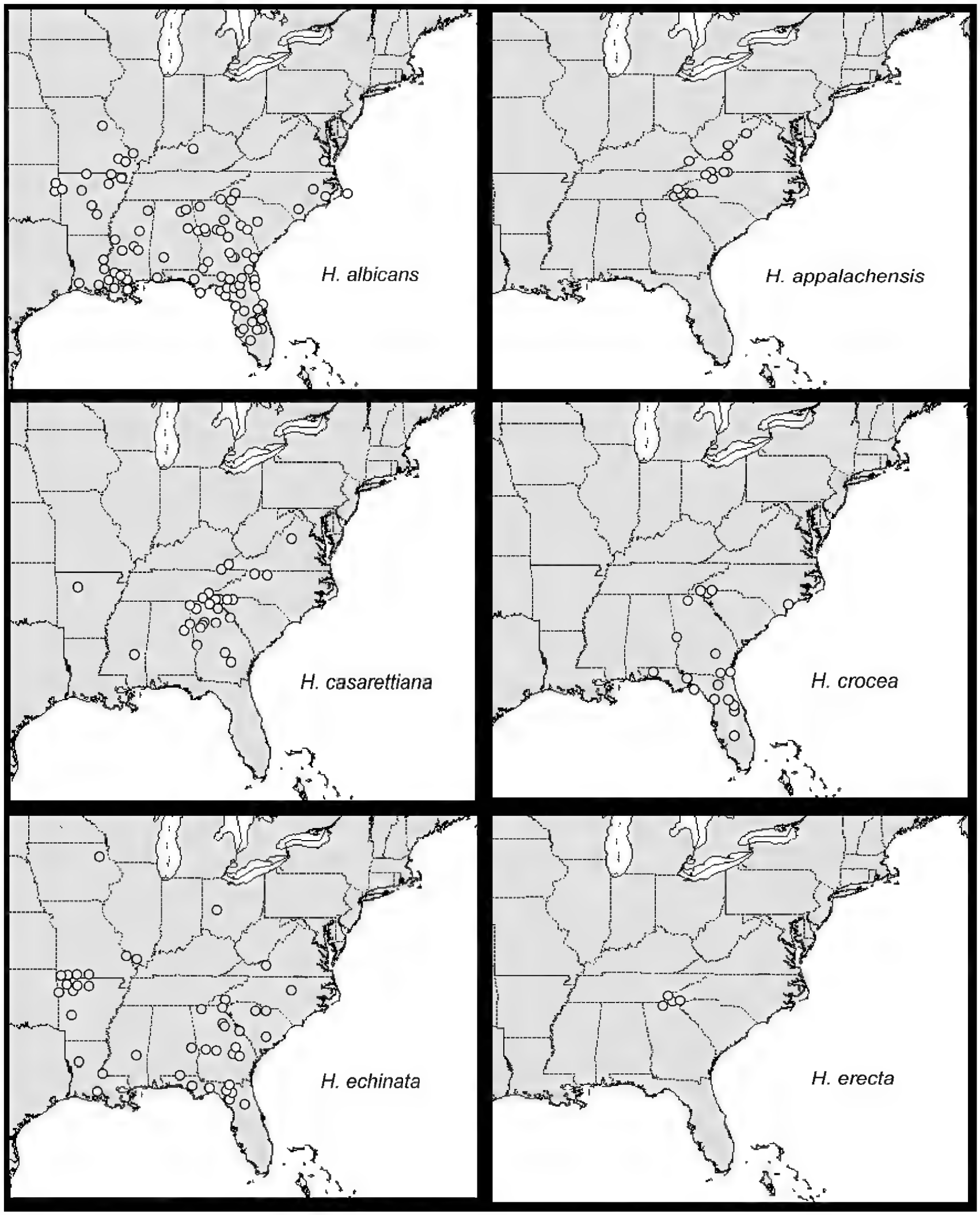

Plate 14. Geographic distributions of *H. albicans, H. appalachensis, H. casarettiana, H. crocea, H. echinata*, and *H. erecta*.

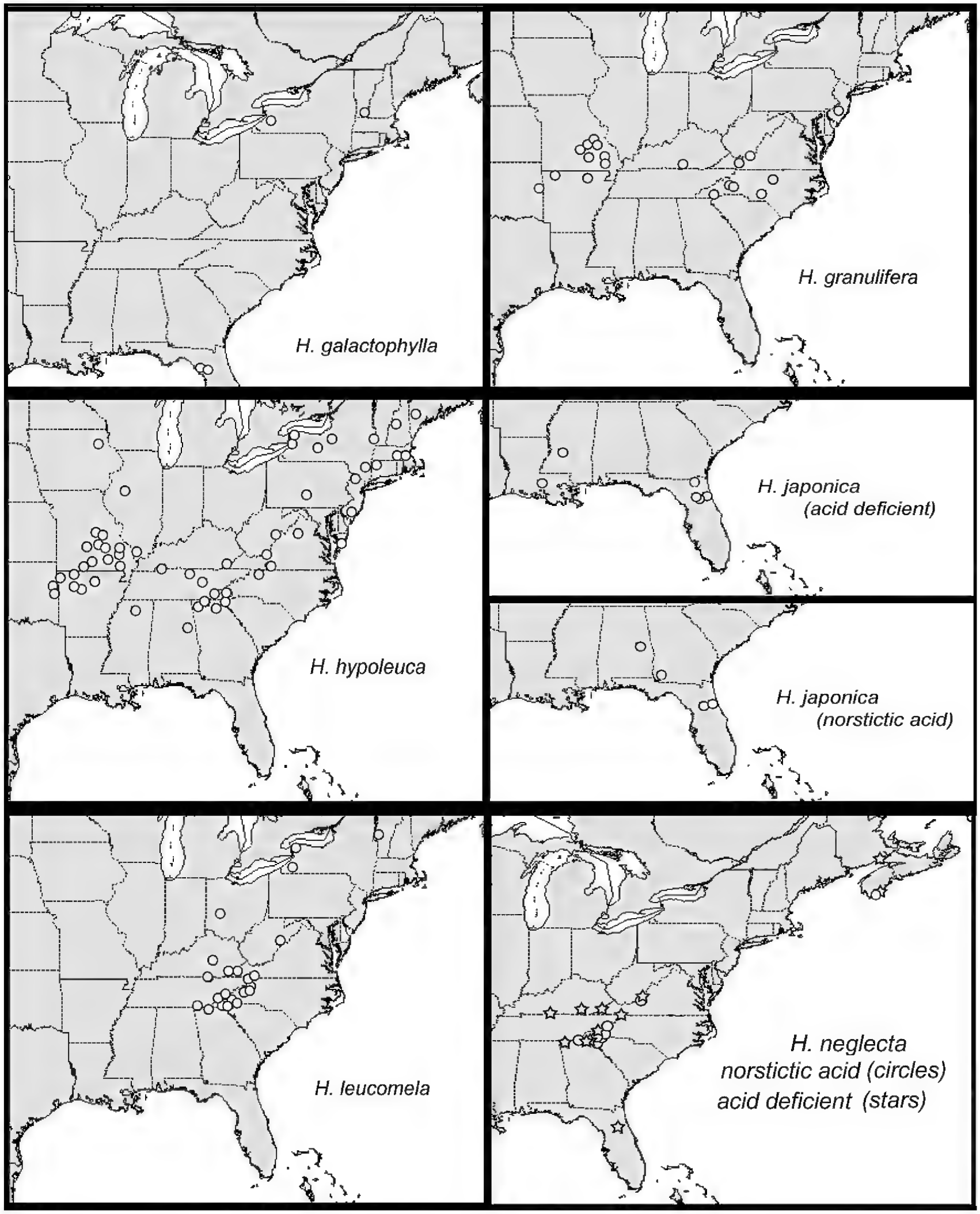

Plate 15. Geographic distributions of *H. galactophylla, H. granulifera, H. hypoleuca, H. japonica, H. leucomela,* and *H. neglecta*.

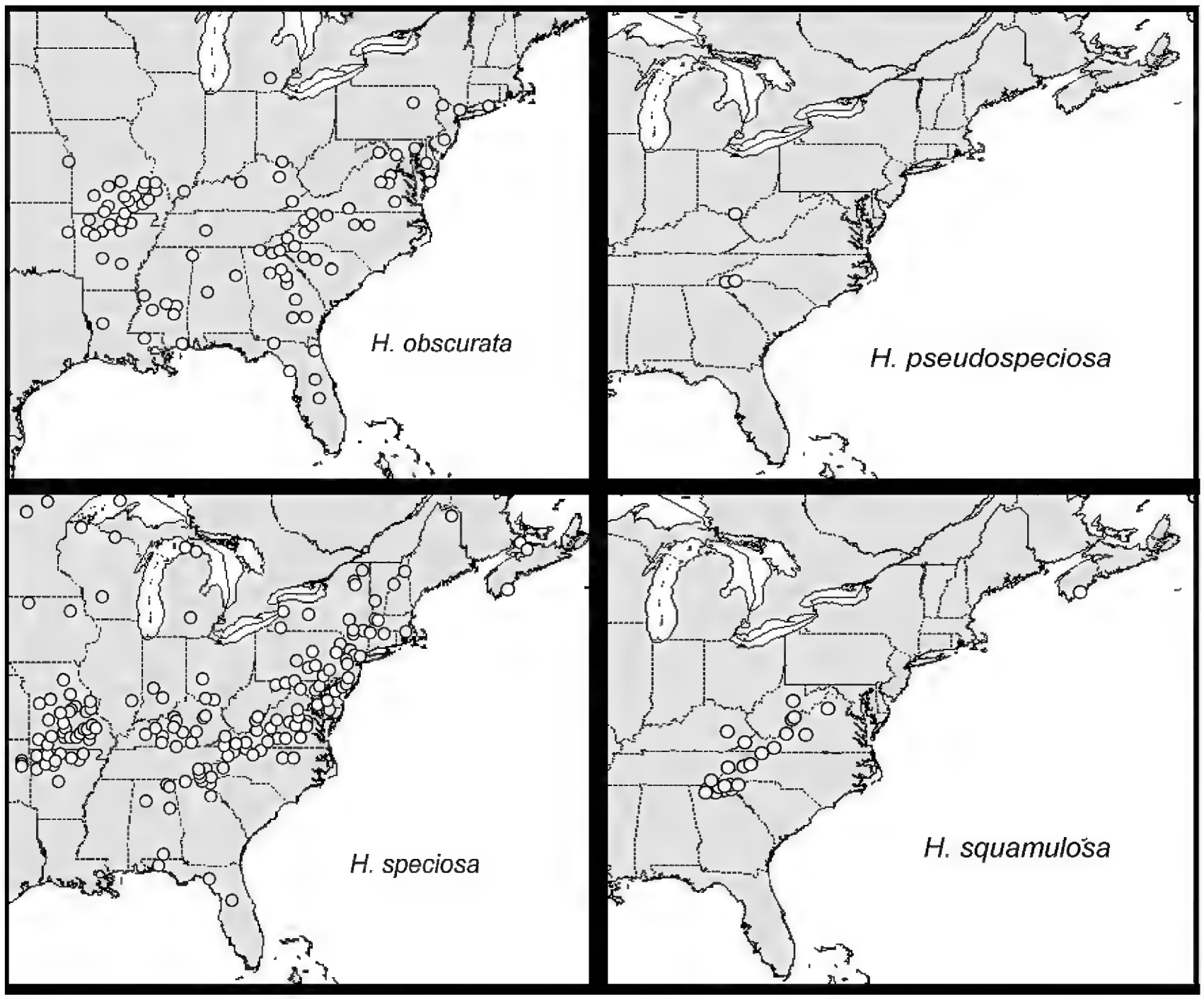

Plate 16. Geographic distributions of *H. obscurata, H. pseudospeciosa, H. speciosa,* and *H. squamulosa*.

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Literature Cited

Aptroot, A. 1987. Pyxinaceae (Lichens). Flora of the Guianas, Series E (Fungi and Lichens), 1: 1-59.

Brodo, I.M., S. Duran Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven & London. 795 pp.

Culberson, W.L. 1966. Chemistry and taxonomy of the lichen genera *Heterodermia* and *Anaptychia* in the Carolinas. The Bryologist, 69: 472–487.

Culberson, C.F., and H. Kristinsson. 1970. A standardization method for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Dey, J.P. 1978. Fruticose and foliose lichens of the high–mountain areas of the southern Appalachians. The Bryologist, 81: 1–93.

Esslinger T.L. 2008. A cumulative checklist for the lichen–forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm (First Posted 1 December 1997, Most Recent Update 18 January 2008), Fargo, North Dakota.

Fryday, A.M., J.B. Fair, M.S. Googe, A.J. Johnson, E.A. Bunting, and L.A. Prather. 2001. Checklist of lichens and allied fungi of Michigan. Contributions to the University of Michigan Herbarium, 23: 145–223.

Harris, R.C. 1990. *Some Florida Lichens*. Publ. by the Author, Bronx, N.Y. 109 pp.

Harris, R.C. 1995. More Florida Lichens. Including the 10ø Tour of the Pyrenolichens. Publ. by the Author, Bronx, N.Y. 192 pp.

Harris, R.C. 1995a. New or rare lichens/lichenicolous fungi for North America. Evansia, 12: 154–156.

Kurokawa, S. 1959. Anaptychiae (lichens) and their allies in Japan (1). Jour. Jap. Bot., 34(4): 117–124.

Kurokawa, S. 1962. A Monograph of the Genus *Anaptychia*. Beihefte zur Nova Hedwigia, No. 6. J. Cramer. 115 pp.

Kurokawa, S. 1973. Supplementary notes on the genus *Anaptychia*. Jour. Hattori Bot. Lab, 37: 563–607.

Kurokawa, S. 1998. A catalogue of *Heterodermia* (Physciaceae). Folia Cryptogamica Estonica 32: 21–25.

Lendemer, J.C., R.C. Harris, and E. Tripp. 2007. *Heterodermia neglecta*, a New Lichen Species from Eastern North America. The Bryologist, 110(3): 562–565.

McCune, B., J. Dey, J. Peck, K. Heiman, and S. Will–Wolf. 1997. Regional gradients in lichen communities of the southeast United States. The Bryologist, 100(2): 145–158.

Moberg, R. 2004. Notes on foliose species of the lichen family Physciaceae in southern Africa. Symbolae Botanicae Upsalienses, 8(1): 257–288.

Moberg, R. and T.H. Nash III. 2002. *Heterodermia*. *In:* Nash III, T.H., B.D. Ryan, C. Gries, F. Bungartz (eds.): Lichen Flora of the Greater Sonoran Desert Region. I. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 207–219.

Purvis, O.W., B.J. Coppins, D.J. Hawksworth, P.W. James, and D.M. Moore (eds.). 1992. The Lichen Flora of Great Britain and Ireland. Natural History Museum Publications & British Lichen Society, London. 710 pp.

Schumm, F. 2001. Hilfsschlüssel zum Bestimmen der Arten der Gattung *Heterodermia* mit podocarpa–Wuchsform. Aktuelle Lichenologische Mitteilungen, 6: 23–34.

Yoshimura, I. and A.J. Sharp. 1968. Some lichens from the southern Appalachians and Mexico. The Bryologist, 71: 108–113.

Opuscula Philolichenum, **6**: 37-40. 2009.

Caloplaca obamae, a new species from Santa Rosa Island, California

KERRY KNUDSEN[1]

ABSTRACT. – *Caloplaca obamae*, a sterile terricolous species is described. The species has a well developed hypothallus of rhizohyphae and discreet patches of orange granules mostly 30–50 µm in diameter, usually coalesced and adhering to one another. It appears to be endemic to the Pleistocene marine terraces on the north side of Santa Rosa Island in California.

KEYWORDS. – Biological crusts, Channel Islands, Channel Islands National Park, grazing, Obama, restoration.

INTRODUCTION

The north Channel Islands of California (Anacapa, Santa Cruz, San Miguel, and Santa Rosa) support a diverse lichen biota of over four hundred species (Knudsen, unpublished data). The genus *Caloplaca* is represented by at least 27 taxa (Wetmore 2007) of which 24 have been collected on Santa Rosa Island (Knudsen, unpublished data). During a continuing floristic survey of Santa Rosa Island a new *Caloplaca* species was collected on soil, growing alone or in biological crusts at seven sites on Pleistocene marine terraces. This taxon is described here as *Caloplaca obamae*. The species is of particular ecological interest in the context of the management and restoration of Santa Rosa Island because it belongs to a community of organisms that has suffered significant degradation on the Channel Islands as a result of the introduction of non-native animals, particularly cattle, deer and elk.

METHODS

Specimens were studied using hand sections with standard light microscopy. Measurements of anatomical characters are based on water mounts prior to the application of (10% KOH, or I for structural study). Brilliant cresyl blue (Bcr) was used to stain structures. Several specimens were studied dry using a Baush & Lomb StereoZoom 7 dissecting microscope and images were captured using a Nikon CoolPix990 digital camera. Illustrations were prepared using Adobe Photoshop.

THE NEW SPECIES

***Caloplaca obamae* K. Knudsen sp. nov.**
MYCOBANK #512895.

Thallus terricola, granulis aurantiacis, 30–50 µm latis compositis.

TYPE: **U.S.A. CALIFORNIA**. SANTA BARBARA CO.: Santa Rosa Island, Channel Islands National Park, on alluvial bench just above bottom of Soledad Canyon, near crossing of Smith Highway, 33°59'12"N, 120°08'20"W, 96 m, on soil with *Leprocaulon microscopicum* and probably *Caloplaca ludificans,* 23.x.2008, *K. Knudsen 10545 w/ S. Chaney & K. Niessen* (UCR, holotype; PRM, isotype).

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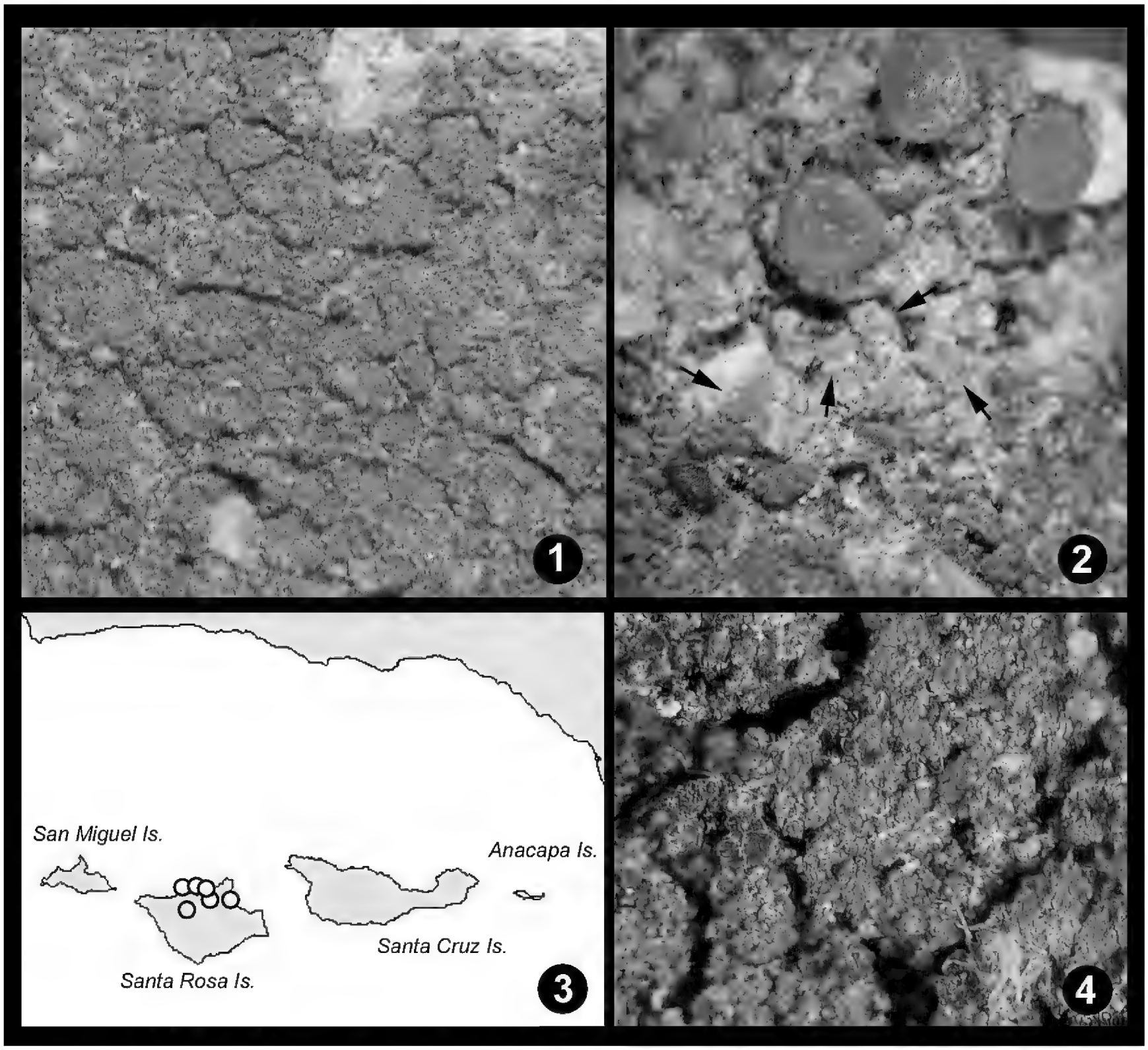

Plate 1. *Caloplaca obamae*. Figure 1, aspect of thallus on loosely consolidated soil (*Knudsen 10572*, NY, x10). Figure 2, detail of apothecia and apothecia initials (arrows), probably of *C. ludificans,* rarely found intermixed with *C. obamae* (*Knudsen 10547*, NY, x15). Figure 3, known geographic distribution of *C. obamae*. Figure 4, aspect of thallus on well consolidated soil (*Knudsen 10568*, NY, x10).

DESCRIPTION. – *Thallus* thin chasmolithic crust, often unapparent, verruculose, with thin whitish to hyaline phenocortex, not forming areoles or squamules, with abundant discreet patches of orange granules, 0.2–1 mm in diam., covering areas up to 6–7 cm, sometimes intermixed with other terricolous lichens and bryophytes in biological soil crusts. *Granules* orange, mostly 30–50 µm in diam., usually coalesced and adhering to one another, K+ purple, C–, paraplectenchymatous cortex around an algal core, 1–4 layers thick, cells mostly 2–3 µm in diam., without any projecting hyphae. *Algal layer* a discontinuous thin stratum, usually 50–100 µm thick, well–developed beneath patches of granules, but usually lacking between the patches of granules. *Hypothallus* stabilizing the substrate with a rhizohyphal weft, with hyaline rhizohyphae 1–2 µm thick, apparently with a few longer hyaline rhizines 3–4.5 µm thick, mixed with soil fungi and bacteria and becoming gelatinized.

Among the sterile thalli of *C. obamae* small patches of apothecia and pycnidia are rarely found. These are described below but not included in the diagnosis (above). They may belong to *C. obamae,* but probably belong to *C. ludificans* Arup, which is common on Santa Rosa Island and can grow on soil.

Apothecia 0.2–0.4 mm in diam., lacking a thalline margin. *Proper margin* orange, slightly elevated above the disc, epruinose, of radiating thin–walled, short–celled hyphae, 50–70 µm wide, K+ purple, C–. *Disc* orange, usually slightly paler than margin, rough, epruinose, K+ purple, C–. *Epihymenium* yellow–orange, granular inspersed; *hymenium* hyaline, 50–100 µm thick; *paraphyses* mostly 2 µm thick, no branching observed, apices expanded to up to 4 µm wide; *hypothecium* 20–30 µm wide. *Asci* 40–50 x 10–17 µm. *Ascospores* (14.1)–14.9–(15.6) x (4.9)–5.4–(5.9) µm (*n*=14, average ± SD), septum 2–4 µm wide. *Pycnidia* rare, immersed, orange; *conidia* bacilliform to narrowly ellipsoid, 2.0–3.5 x 1.0–1.5 µm.

ETYMOLOGY. – The species is named in honor of Barack Obama, President of the United States. The final collections of this species were made during the suspenseful final weeks of Obama's campaign for president and this paper was written during the international jubilation over his election. The final draft was completed on the day of his inauguration. He is honored for his support of science and scientific education.

ECOLOGY AND DISTRIBUTION. – *Caloplaca obamae* occurs on soil on Pleistocene marine terraces and benches in associated canyons on the north side of the Santa Rosa Fault, from the bluffs of Vail Ranch on Beecher Bay to Soledad Canyon, except in the stabilized dune fields of Carrington Point. This whole area has been heavily grazed for over a hundred years and supports mostly disturbed grassland. *Caloplaca obamae* is easily disturbed if stepped on, but its asexual propagules of small granules as well as hypothallus can probably readily reestablish the species. Cattle grazing only ceased in 1998 on Santa Rosa Island. Game deer and elk still roam the island grazing and will not be removed until 2011. It is expected that *C. obamae* will make a vigorous comeback in the next fifty years on the marine terraces of Santa Rosa Island with the end of grazing and reestablishment of the native vascular flora. Though generally collected alone, one biological crust examined on Brockway Point suggests that *C. obamae* and *Endocarpon pusillum* Hedw. would be important and vigorous components in the natural restoration of biological crusts.

Caloplaca obamae has not yet been collected on the mainland of California or on the other Channel Islands. Like many terricolous crusts in southern California it may be rare because of human development of suitable habitats, as well as habitat degradation from invasive weeds and regular soil disturbance by human usage or animals.

DISCUSSION. – Lacking an areolate crust and forming granules, *Caloplaca obamae* differs from two sorediate species that occur on soil in western North America and Europe, *C. citrina* (Hoffm.) H. Olivier and *C. tominii* (Savicz) Ahlner (Arup 1993, 2006; Wetmore 2001). Neither species has been reported on soil from the Channel Islands. *Caloplaca citrina* is common on wood, bark and rock, and may include several taxa, but is rarely found on soil in western North America (Arup 1993, Wetmore 2007). *Caloplaca tominii* has not yet been collected in southern California and occurs exclusively on soil (Wetmore 2007). Both species differ from *C. obamae* in having corticate areoles, rather than a chasmolithic non–areolate thallus with a well–developed hypothallus of rhizohyphae, and in producing soredia rather than having granules.

Though rock was abundant at several sites where *C. obamae* occurs, it was not found on rock. Considering that the current populations are probably relictual, rock would have been a perfect substrate to persist on during the disturbance of soil habitats by grazing as some terricolous lichens are known to do such as *Aspicilia glaucopsina* (Nyl. ex Hasse) Hue and *Acarospora obpallens* (Nyl. ex Hasse) Zahlbr. that can occur on sandstone. But like *A. schleicheri* (Ach.) A. Massal. and *A. terricola* H. Magn., *C. obamae* does not appear to be adapted to rock substrates and produces an abundant hypothallus of rhizohyphae and rhizines as do other terricolous species of genera such as *Endocarpon* Hedw. and *Placidium* A. Massal. Though *C. obamae* grew in one specimen on some partially buried vegetative detritus, it was not found on the bark or wood of any coastal sage shrubs which occur at most of sites where *C. obamae* was collected.

Caloplaca obamae looks most similar to *C. xanthostigmoidea* (Räs.) Zahlbr. (syn. *C. epiphyta* Lygne) an areolate species with a circumpolar distribution in Japan, North America (largely north of the continental United States except for populations in the Appalachian Mountains), and northern Europe (Søchting & Tønsberg 1997, Wetmore 2001), which forms similar sized granules but is often abundantly fertile. It is usually corticolous although it also occurs on calcareous rock or soil and organic matter overlaying calcareous rocks. *Caloplaca obamae* of course differs from *C. xanthostigmoides* in not having areoles, in having a well developed hypothallus adapted to a terricolous habit, and in not being found on rock or on the bark of shrubs or trees. The marine terraces of Santa Rosa Island are formed mostly of a fine clay, derived partially from Monterey shale, or sand, and are not calcareous. *C. obamae* has not been

discovered on soils derived from caliche in the Sandy Point area of Santa Rosa Island, and it is has not been found on the similar calcareous soil of San Miguel Island.

In the specimens of *Caloplaca obamae* that were collected, apothecia (see figure 2) were rare and if present were generally limited to one or two except in the holotype. They are described above in case they belong to *C. obamae*, but probably belong to *C. ludificans*. It is more likely that *C. obamae* is completely sterile as it can easily propagate on the marine terraces without producing ascospores. The species is easily recognized in the field. The sterile orange patches of granules always form a discreet pattern.

No lichenicolous fungi were found on any specimens.

Additional Specimens Examined (all paratypes). – **U.S.A. CALIFORNIA**. SANTA BARBARA CO.: Santa Rosa Island, Channel Islands National Park, bluff above ocean between Lobos Canyon and Cow Canyon, 34°01'05"N, 120°06'00"W, 54 m, 25.x.2008, *K. Knudsen 10568* (NY, UCR), *K. Knudsen 10572* (B, NY, UCR); bluffs west of Verde Canyon, 34°01'13"N, 120°07'11"W, 50 m, 19.viii.2007, *K. Knudsen 8911.2* (UCR); Vail Ranch, abandoned pasture near maritime bluff, 34°00'06"N, 120°03'01"W, 26 m, 17.viii.2007, *K. Knudsen 8808* (PRM, UCR); above Lobos Canyon along Smith Highway, 34°00'16"N, 120°05'25"W, 124 m, 24.x.2008, *K. Knudsen 10547, S. Chaney & K. Niessen* (NY, fertile; UCR, sterile); Brockway Point, 34°01'20"N, 120°08'45"W, 64 m, 24.x.2008, *K. Knudsen 10523* (PRM, UCR); gully between Dry Canyon and Verde Canyon, 33°59'48"N, 120°06'56"W, 124 m, 24.x.2008, *K. Knudsen 10529* (UCR).

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Literature Cited

Arup, U. 1993. *Caloplaca flavogranulosa* sp. nov. and *C. citrina,* two sorediate species on seashore rocks in western North America. The Bryologist, 95: 598–603.

Arup, U. 2006. A new taxonomy of the *Caloplaca citrina* group in the Nordic Countries, excluding Iceland. The Lichenologist, 38 (1): 1–20.

Søchting, U. and T. Tønsberg. 1997. *Caloplaca xanthostigmoidea* (Räs.) Zahlbr., a common lichen species in cool regions of the northern hemisphere. *In:* Tibell, L., Hedberg, I. (eds.): Lichen Studies Dedicated to Rolf Santesson. Acta Universitatis Upsaliensis, Symbolae Botanicae Upsalienses, Uppsala, pp. 247–253.

Wetmore, C.M. 2001. The *Caloplaca citrina* group in North and Central America. The Bryologist, 104: 1–11.

Wetmore, C.M. 2007 (2008). *Caloplaca In*: Nash III, T.H., Gries, C., Bungartz. Lichen Flora of the Greater Sonoran Desert Region, Vol. 3, Tempe, Arizona: Lichens Unlimited, Arizona State University, pp. 179–220.

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A New Species of *Sphaerellothecium* (Mycosphaerellaceae) on *Placidium lacinulatum*

KERRY KNUDSEN[1], JANA KOCOURKOVÁ[2] & JAVIER ETAYO[3]

ABSTRACT. – A new species, *Sphaerellothecium breussii,* is described from western North America.

KEYWORDS. – California, *Epibryon conductrix*, lichenicolous fungi, Santa Monica Mountains, *Sphaerellothecium parmeliae, Stigmidium catapyrenii.*

INTRODUCTION

The lichenicolous genus *Sphaerellothecium* Zopf has perithecial ascomata and is usually distinguished by the formation of a reticulum formed of superficial dark hyphae occurring on the thallus and apothecia of the host. Ascospores are 1–3(–5) septate and hyaline, sometimes turning brown in maturity. In *Sphaerellothecium* unbranched periphyses are present, though often rudimentary and hard to observe. The genus currently is considered to usually have interascal filaments called paraphysoids, that are often hard to observe, but always lacks pseudoparaphyses (*sensu* Roux & Triebel 1994) which are pendent from the upper cavity of the ascomata (Roux & Triebel 1994; Calatayud & Triebel 2003; Cáceres & Tribel 2004). *Sphaerellothecium* is a widespread genus especially in northern temperate regions and currently comprises around 24 taxa (Mycobank 2008; Diederich 2007; Etayo 2008; Zhurbenko & Triebel 2008; Diederich & Zhurbenko 2009). The genus *Echinothecium* Zopf has recently been synonymized with *Sphaerellothecium* (Etayo 2008).

METHODS

Specimens were examined using standard microscope techniques. Handmade sections were studied in water and 10% KOH [K]. Measurements were done in water. Amyloid reactions were tested in 1.0% Lugol's iodine [I] with and without pre–treatment with 10% KOH [K/I]. Chromatic reactions were tested with brilliant cresyl blue (BCr). Photographs were taken with an Olympus C5050 digital camera on an Olympus SZX 9 stereomicroscope and an Olympus BX 50 (to ×1250) compound microscope fitted with Nomarski differential interference contrast.

THE NEW SPECIES

Sphaerellothecium breussii* K. Knudsen, Kocourk. & Etayo *sp. nov.
MYCOBANK #512896.

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Fungus lichenicola. Ascomata perithecioidea, sphaerica, superficialia, nigra, 40–80 µm diam. Hyphae 5–6 µm crassae, fuscae, superficiales, ramosae et anastomosantes. Hamathecium periphysibus simplicibus, 10 x 1 µm. Asci clavati vel saccati, crassitunicati, 8–spori, 30–40(–50) x 10–15 µm diam. Ascosporae 1–septatae, ellipsoidae vel paulum clavatae, hyalinae, (11)–12.1–(13.2) x (3.4)–3.8–(4.15) µm, post maturitatem fuscae, usque ad 16 µm longae.

TYPE: **U.S.A. CALIFORNIA**. SAN DIEGO CO.: Vista, UC Dawson Preserve, 33°8'48"N, 117°14'45"W, 380 m, on *Placidium lacinulatum* in opening of old–growth chaparral, 21.xii.2005, *K. Knudsen 4770.2, V. Reeb & S. Werth* (UCR, holotype; PRM–911254, isotype).

DESCRIPTION. – *Vegetative hyphae* superficial, light golden brown to dark brown, thick–walled, surface smooth to very slightly verruculose, branching, forming an inconspicuous hyphal net, visible only in horizontal section of infected host thallus, mostly 5–6 µm in diam., causing the surface of host thallus to become rough and occasionally fissured visible at high magnification under stereomicroscope, BCr+ blue (Fig. 4). *Ascomata* perithecioid, lacking appendages, ostiolate, 40–80 µm diam., globose, black, semi–immersed to superficial, usually arising from the tips of vegetative hyphae, becoming dense on thallus of host (Figs. 1 & 4). *Ascomata wall* dark brown to black, 1–2 layers thick, paraplectenchymatous, formed by isodiametric cells, mostly 7–8 x 3–4 µm; ostiole prominent. *Hamathecium* of periphyses, simple, narrow, small, mostly 10 x 1 µm, no periphysoids observed, no paraphysoids present, I–. *Asci* cylindrical to clavate or saccate or irregular, with distinct ocular chamber, 8–spored, with ascospores irregularly arranged in ascus, 30–40(–50) x 10–15 µm, ascoplasma I+ orange–red, BCr+ blue, endoascus BCr–. *Ascospores* 1–septate, not halonate, hyaline, becoming brown when overmature, rarely guttulate, not ornamented, slightly constricted or not at septum, cells equal or upper cell slightly larger than lower one, both apices rounded, (11)–12.1–(13.2) x (3.4)–3.8–(4.15) µm (hyaline ascospores) [Average (xbar) +/– 1SD; n=20] (Figs. 2–3), rare over–mature brown ascospores up to 16 µm long. Pycnidia 40–50 µm, conidia cylindrical 5 x 1 µm (Fig. 5).

ETYMOLOGY. – The species is named for our good friend Othmar Breuss in honor of his outstanding work in Verrucariaceae and in the genus *Placidium*, host of *S. breussii*.

HOST. – *Placidium lacinulatum* (Ach.) Breuss is a terricolous lichen widespread in the temperate latitudes in Asia, Europe, northern Africa, North and South America, in dry areas at various elevations (Breuss 2002).

DISTRIBUTION. – Currently known only from southern California. Based on three modern collections from three locations and from historical collections made by H.E. Hasse in the Santa Monica Mountains.

DISCUSSION. – In most species of *Sphaerellothecium* the ascomata arise from a reticulum, a superficial net of dark brown mycelium, one cell wide, with the hyphae being 2–8 µm diameter (Roux & Triebel 1994), and easily visible at 10x magnification using a hand lens. Like *S. parmeliae* Diederich & Etayo, the superficial mycelium of *Sphaerellothecium breussii*, is not readily visible except in strong light at 40 x magnification under a stereomicroscope, but unlike *S. parmeliae* the mycelium does not arise in black necrotic areas, often forms a reticulum, and is wider (5–6 µm vs. 3–4 µm) (Etayo & Diederich 1998). The ascospores of *S. breussii* are longer than *S. parmeliae* (11–13 x 3.5–4 µm vs. 8.5–10 x 3–4 µm) and the ascomata are also tend to be larger (40–80 µm vs. 25–40(–60 µm)). The ascomata of *S. breussii* tend to form at the end of individual strands of the mycelium and then from the new ascocarp new strands may originate or not. Otherwise the mycelium of *S. breussii* is typical of most *Sphaerellothecium* species being composed of dark brown, thick walled hyphae, a single cell wide, with individual cells irregularly swelling (see illustrations of *Sphaerellothecium* mycelium in Roux & Triebel 1994).

In the field *Sphaerellothecium breussii* is easily recognized by the usually abundant superficial black ascomata on squamules of the host (Fig. 1).

Epibryon conductrix (Norman) Nik. Hoffmann & Hafellner, syn. *Stigmidium catapyrenii* Cl. Roux & Triebel, occurs on *Catapyrenium daedaleum* (Kremp.) Stein in the Alps. It has hyaline to pale brown hyphae near the pseudothecia, BCr–; large ascomata of 75–120 µm, immersed, finally semi–immersed, wall composed of several rows of cells, well formed pseudoparaphyses, and thin–walled, halonate ascospores with 1–3 septa (Hoffmann & Hafellner 2000; Roux & Triebel 1994).

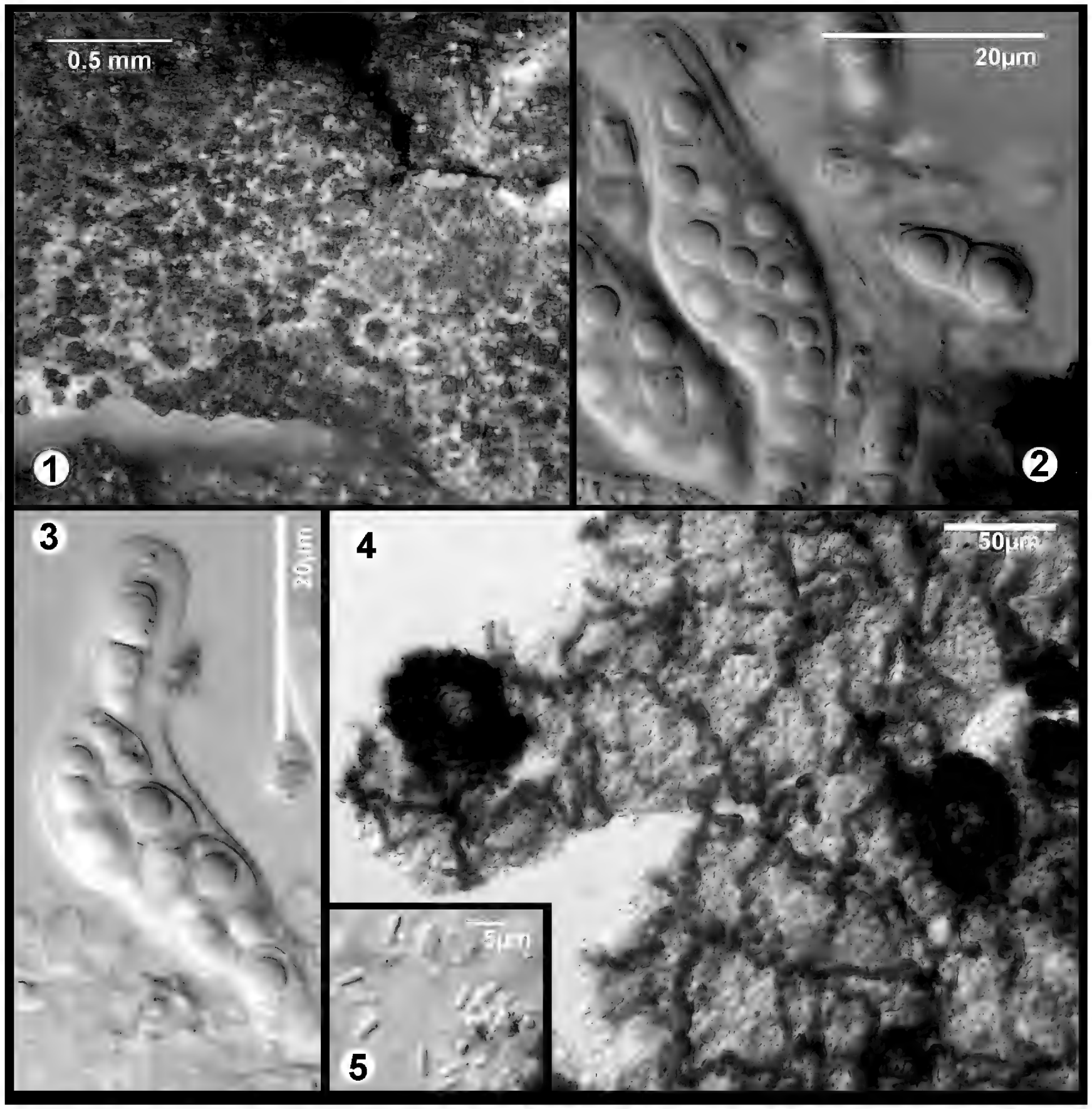

Plate 1. *Sphaerellothecium breussii* (*Knudsen 5934*, PRM-911261; scale bars are indicated). Figure 1, infected thallus of *Placidium lacinulatum*. Figures 2–3, asci and ascospores, ascospore starting process of release in figure 3. Figure 4, superficial mycelium and ascomata of *S. breussii* on thallus of host. Figure 5, conidia.

Additional Specimens Examined (all paratypes). – **U.S.A. CALIFORNIA**. LOS ANGELES CO.: Santa Monica Range, s.d., *H.E. Hasse 546* (NY); 1902, *H.E. Hasse s.n.* (FH). RIVERSIDE CO.: Elsinore Mountains, Elsinore Peak, Cleveland National Forest, 33°35'51"N, 117°21'10"W, 989 m, 16.i.2004, *K. Knudsen 768* (hb. Breuss, hb. Diederich, hb. Etayo, M–0045651, UCR). SAN BERNARDINO CO.: base of San Bernardino Mountains, wash of the Santa Ana River, along Greenspot Road, 34°05'31"N, 117°06'45"W, 533 m, 1.v.2006, *K. Knudsen 5934.2 & M. Knudsen* (PRM–911261).

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Literature Cited

Breuss, O. 2002. *Placidium. In:* Nash, T.H., III, Ryan, B.D., Gries, C., Bungartz, F. (eds.): Lichen Flora of the Greater Sonoran Desert Region. I. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 384–393.

Cáceres, M.E.S. and D. Triebel. 2004. *Sphaerellothecium. In:* Nash, TH, III, Ryan, B.D., Diederich, P., Gries, C., Bungartz, F. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 696–699.

Calatayud, V. and D. Triebel. 2003. Three new species of *Stigmidium* s. lato. (lichenicolous ascomycetes) on *Acarospora* and *Squamarina*. Lichenologist, 35(2): 103–116.

Diederich, P. 2007. *Sphaerellothecium gallowayi* sp. nov., a new lichenicolous ascomycete on *Heterodermia* from Australia and Papua New Guinea. *In:* Kärnefelt, I.; Thell, A.: Lichenological Contributions in Honour of David Galloway. Bibliotheca Lichenologica, 95. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin–Stuttgart, pp. 165–169.

Diederich, P. and M.P. Zhurbenko. 2009. *Sphaerellothecium phaeorrhizae* and *Zwackhiomyces sipmanii* spp. nov. on *Phaeorrhiza sareptana* from north–eastern Asia, with a key to the species of *Spharellothecium. In:* Aptroot, A., Seaward, M. R. D., Sparrius, L.B. (eds.): Biodiversity and ecology of lichens. Bibliotheca Lichenologica, 99: 113–122.

Etayo, J. 2008. Líquenes y hongos liquenícolas del LIC de Ablitas (S. Navarra, España). Cryptogamie, Mycologie, 29: 63–94.

Etayo, J. and P. Diederich. 1998. Lichenicolous fungi from the western Pyrenees, France and Spain. IV. Ascomycetes. Lichenologist, 30(2): 103–120.

Hoffmann, N.M. and J. Hafellner. 2000. Eine Revision der lichenicolen Arten der Sammelgattungen Guignardia und Physalospora (Ascomycotina). Bibliotheca Lichenologica, 77: 1–181.

Mycobank. 2008. www.mycobank.org. Accessed August 10, 2008.

Roux, C. and D. Triebel. 1994. Révision des espèces de *Stigmidium* et de *Sphaerellothecium* (champignons lichénicoles non lichénisés, Ascomycetes) correspondant à *Pharcidia epicymatia* sensu Keissler ou à *Stigmidium schaereri* auct. Bulletin de la Société Linéenne de Provence, 45: 451–542.

Zhurbenko, M.P. and D. Triebel. 2008. Three new species of *Stigmidium* and *Sphaerellothecium* (lichenicolous ascomycetes) on *Stereocaulon*. Mycological Progress, 7: 137–145

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Pseudevernia furfuracea, the mummy's lichen at the Farlow Herbarium

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ABSTRACT. – We recently rediscovered a specimen of the lichen *Pseudevernia furfuracea* (L.) Zopf, that is over 2,500 year old. It is part of the Farlow Herbarium collection (FH-TUCK) at the Harvard University Herbaria and was found on an Egyptian mummy from Thebes that was unwrapped by the Montreal Natural History Society in 1859. This paper presents a historical review of the lichen and the mummy as well as information on the uses of lichens in ancient Egypt.

KEYWORDS. – Sir William Dawson, embalming, *Evernia,* David Allan Poe Watt, hieroglyphics, lichen substances, Natural History Society of Montreal, Redpath Museum, Tuckerman

We recently rediscovered a lichen specimen of *Pseudevernia furfuracea* (L.) Zopf (syn. *Evernia furfuracea* (L.) W. Mann) that was found in between the wrappings of a female Egyptian mummy. The mummy was unwrapped in 1859 by the Natural History Society of Montreal and part of the recovered lichen specimen had been sent, probably by D. Allan Poe, to Edward Tuckerman for identification. Tuckerman included it in his collection on sheet no. 330. His herbarium was purchased in 1886 after his death by William G. Farlow, and it is now part of the cryptogamic collection of the Farlow Herbarium (FH; Pfister 1982). The lichen specimen is kept in a hand folded package and is labeled in Tuckerman's handwriting '*Evernia furfuracea* cetatis c. 2500 ann.!' On the bottom of the package it says further: 'From within of wrappings of a Mummy fr. Egypt. Est. as from 500 to 800 years B.C. old. Unrolled by the Montreal Nat. Hist. Society in 1859, as see Mr. D. Allan Poe's letter of 1 Nov. 1859. "Several handfuls of the lichen were found on the chest of the Mummy, over the spices, + within all the wrappings"' (plate 1).

David Allan Poe, who changed his name in 1862 to David Allan Poe Watt, was a life member of the Natural History Society of Montreal (Miller 2000, Monck 1862, Natural History Society 1859). He was active in several committees from 1857 onward and was appointed as one of the vice-presidents at the annual meeting in 1881 (Natural History Society 1881). Poe was possibly part of the party that unwrapped the mummy in 1859. The unwrapping probably took place at McGill College (now McGill University) in Montreal, Canada. Unfortunately, no first hand account of the unwrapping nor the letter mentioned by Tuckerman on the package could be found in the archives of FH or at McGill University.

A duplicate of the *Pseudevernia furfuracea* that was found on the mummy is deposited in the General Herbarium at FH. It was originally part of the Gray Herbarium and is labeled as '*Evernia furfuracea*, from chest of a mummy, Dawson: Can. Nat. & Geol. 7: 88-9. 1862'. A third piece of this lichen is housed at the British Natural History Museum (BM; LaGreca, pers. comm.). It is unknown if the specimens from the Gray Herbarium and from BM had been sent on behalf of the Natural History Society of Montreal or were distributed by Tuckerman.

Sir William Dawson, whose name is mentioned on the duplicate of *Pseudevernia furfuracea* in the General Herbarium at FH, became the principal of McGill College in Montreal in 1854 (Nova Scotia Museum 2008). Dawson was acting president of the Natural History Society of Montreal for a number of years, starting in 1856-1857 (Natural History Society 1881). He was named the director of the Redpath

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Plate 1. Specimen of *Pseudevernia furfuracea* at FH that is the subject of this article (scale bar = 1cm). Figure 1, specimen. Figure 2, original packet from the Tuckerman Herbarium (FH-TUCK).

Plate 2. Figure 1, the mummy "Abothloé". Figure 2, hieroglyphic representation of the name of the mummy " Abothloé". Figure 3, hieroglyphics that possibly represent 'lichen' (in gray box).

Museum of Natural History in 1882, when Peter Redpath donated money to McGill College for the construction and establishment of a museum. The collection of the Redpath Museum includes many specimens from Dawson's personal collection, including three Egyptian mummies.

The mummies were brought to Montreal as part of 'Egyptian curiosities recently brought to this City by the Hon. James Ferrier, and presented by him to the Natural History Society' (Dawson & a committee 1859). Amongst these 'curiosities' was a mummy of an aged lady from Thebes (plate 2, figure 1). According to the investigations she was in excellent preservation, and her body was entombed in a highly ornamented case (Dawson & a committee 1859). Her name is preserved opposite of the portrait on the bottom of the coffin and 'may have been "Abothloé"' (Dawson & a committee 1859; plate 2, figure 2). Hair analysis and head measurements revealed that she was a person of the European type. She was embalmed in what appeared to be the oldest style with 'A quantity of lichen … placed over the front part of the body to give it a more rounded contour, and to retain the odor of the spices; and it had been swathed in numerous linen cloths, folded over the front, and with many loose pieces put in to fill out the form' (Dawson & a committee 1859).

The pieces of *Pseudevernia furfuracea* that were sent to Tuckerman are reasonably large (up to about 5 cm long) and are still partly attached to a piece of a twig (plate 1, figure 1). If the dating for the embalmment of Abothloé mentioned on the package is correct (500-800 B.C.), the age of the lichen ranges at least from about 2500 to 2800 years. The use of the words 'oldest style of embalming' in Dawson's paper (1859) can be confusing, however, and possibly could lead to a different dating of the mummy and therefore of the lichen. The idea of mummification probably existed already during the predynastic times (before 3050 B.C.) when naturally dried bodies were buried in sandy pits with some burial objects (Ikram & Dodson 1998). The way Abothloé was mummified included the desiccation of the body (probably with natron), the removal of the inner organs, and the coverage of parts of the body with oily or resinous varnish and with a paste of ground spices (Dawson & a committee 1859). The brain was removed through the nose (Lawson, pers. comm.). Square plates of copper foil had been placed over her face and the upper part of her feet.

The regular use of natron and resin for mummification is known since about the Middle Kingdom (2066-1650 B.C.) and also the removal of the brain through the nose is known before the time Abothloé was embalmed (Ikram & Dodson 1998). As far as we know, during the New Kingdom (1549-1069 B.C.) and the Third Intermediate Period (1069-656 B.C.) lichens were used in mummification. The body cavities of e.g., the mummies of Merenptah, Siptah, Ramses IV, a priest from the 21 dynasty (1069-940 B.C.), and an unknown male from the 23-24 dynasty (743-717 B.C.) were filled with *Pseudevernia furfuracea* (Dawson 1934, Germer 1988, Ikram & Dodson 1998). Normally, the mummies were filled with sawdust, linen or sand after they were treated with resin for disinfection.

But where did the lichens used in mummification came from? The first herbarium specimen of any lichen was not collected until around 1750 by Frederic Hasselquist (now at UPS), and the first published records of lichens from Egypt are known from 1813 (Delile 1813a, 1813b). We therefore do not have direct records of the lichens that were possibly growing in ancient Egypt. However, Baumann (1960) stated that *Evernia furfuracea* did not grow in Egypt and also Seaward & Sipman (2006) did not list *Pseudevernia* in their checklist of lichenized and lichenicolous fungi for Egypt. According to Poucher (1936), *E. furfuracea* and the very similar species *E. prunastri* (L.) Ach. do not grow in Egypt because of the dry air. '…but in the last century Forstal saw several consignments being unloaded in Alexandria. These had been shipped from the Islands of the Archipelago' (Poucher 1936). Dawson (1862) states that the lichens had been imported into Egypt from Lebanon or the hills of Macedonia, but he does not support this assertion. There are several other countries that are mentioned in the literature as possible traders in lichens with Egypt. Southern Europe (such as Greece) and Asia Minor are the general regions from which the lichen could have had been imported (Germer 1988, 1993). However, we have no evidence from which country or region lichens were imported into Egypt.

Unlike many higher plants used in the embalming process, the hieroglyphics for the word 'lichen' are still arguable. Plate 2, figure 3 shows the hieroglyphics that possibly represent 'lichen' (Dawson 1934) with its transcription being 'kꜣ.t-šw.t' (Dawson 1934, Germer 1979, Von Deines & Grapow 1959). Dawson (1934) interpreted the beard shaped sign in plate 2, figure 3 (marked with a gray rectangle) as the part that gives an indication about the shape of the plant 'kꜣ.t-šw.t' that was used as a medicinal drug, and suggested that it is 'some kind of lichen'. If this is true, then lichens were used externally and as a fumigant for curing ulcerous or other infections, the mht.t-disease (the nature of this disease is unknown; this is the reason why the Egyptian transcription is still used), and pain (Germer 1979). Plinius Secundus speaks in 1513 of two different lichen species as being good for treating the skin disease 'lichen', stigmas, bleedings, and icterus (König 1983). This is not surprising, because lichens are known for their antimicrobial properties (Richardson 1974). Von Deines & Grapow (1959) and Germer (1988) mention 'kꜣ.t-šw.t' as being used as an addition to incense and in bandages. It is well known that some lichens, including *Pseudevernia furfuracea*, are used in the perfume industry and are able to enhance the aromas from other plants (Lindley 1838, Perez-Llano 1944, Poucher 1936). We also know for sure that Egyptians used *P. furfuracea* in baking bread as a substitute for *Evernia prunastri*, and that it was an additive in making hair powders (Lindsay 1856). As we are aware, fruticose lichens often resemble the shape as illustrated in the hieroglyphics in plate 2, figure 3. But as pointed out by Germer (1979), *P. furfuracea*, probably the most commonly used lichen in ancient Egypt, looks very different in its growth form. So it will remain unsure if the plant 'kꜣ.t-šw.t' means 'lichen', a specific lichen species or simply some other plant.

The function of lichens used in mummification is not yet completely solved (Baumann 1960, Ikram & Dodson 1998). In cases where mummies were stuffed with them they might have been applied to preserve the shape of the body, for antimicrobial purposes, for preservative properties or for their absorbent character (Baumann 1960, Ikram & Dodson 1998, Richardson 1974). In cases such as for Abothloé, where the lichens were applied within the wrappings, they indeed might have been added to preserve the odor of the other spices as mentioned on the package of the herbarium specimen.

Dawson (1862) made an interesting connection between the *Pseudevernia furfuracea* that had been found on the mummy and the *P. furfuracea* that occurs in the White Mountains, Maine. The paper is about the flora of the White Mountains and Dawson includes cryptogams in his investigations. He describes on page 88 the unwrapping of the mummy, the findings of the spices and the lichen *P. furfuracea* within the wrappings as well as the necessity of the import of the species into Egypt. After he mentions the identification of the lichen by E. Tuckerman, he states '…, as it occurs on the White Hills and on Katahdin in Maine. These facts are however easily explicable in comparison with those that relate to the flowering plants.' According to Dawson (1962) the spores of the lichens that 'float lighter than the lightest down in

the air' may have drifted over oceans and continents and 'dropped everywhere to grow where conditions may be favorable.' His hypothesis is that when the Egyptian embalmer had used the 'first created specimens of *Evernia furfuracea*, it might easily within the three thousand years or so since his work was done, have floated round the world and established itself on the White Hills'. His article and hypothesis was recently cited in a newspaper article about atmospheric deposition (Collard 1990).

Interestingly, the secondary compounds of the *Pseudevernia furfuracea* found on Abothloé are still preserved, even after over 2500 years. As analysis with high performance liquid chromatography (HPLC) reveal, physodic acid, isophysodic acid, atranorin, and chloroatranorin are detectable, along with degradation products from physodic and/or oxyphysodic acid (Elix, pers. comm.). Results from thin layer chromatography (TLC) were, however, negative (LaGreca, pers. comm.).

The mummy Abothloé is one of the Egyptian mummies on permanent display at the Redpath Museum, McGill University, Canada.

Acknowledgements

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Literature Cited

Baumann, B.B. 1960. The botanical aspects of ancient Egyptian embalming and burial. Economic Botany, 14: 84–104.

Collard, E.A. 1990. What goes up will come down. The Gazette, November 17, 1990.

Dawson, Sir J.W. and a committee. 1859. Notes on Egyptian Antiquities presented to the Natural History Society. Canadian Naturalist and Geologist, 4: 401–407.

Dawson, Sir J.W. 1862. Notes on the flora of the White Mountains, in its geographical and geological relations. Canadian Naturalist and Geologist, 7: 83–102.

Dawson, W.R. 1934. Studies in the Egyptian Medical Texts III. Journal of Egyptian Archaeology, 20: 46.

Deines, von H. and H. Grapow. 1959. Wörterbuch der ägyptischen Drogennamen. Grundriss der Medizin der alten Ägypter, Vol. 6. Akademie–Verlag, Berlin. pp.1–634.

Delile, A.R. 1813a. Florae aegypticae illustration. Paris.

Delile, A.R. 1813b. Flore d'Egypte. Paris.

Germer, R. 1979. Untersuchung über Arzneimittelpflanzen im alten Ägypten. Dissertation, University of Hambrug. pp. 1–400.

Germer, R. 1988. Katalog der Altägyptischen Pflanzenreste der Berliner Museen. Ägyptologische Abhandlungen, Vol. 47. Otto Harrassowitz, Wiesbaden. pp.1–72 with 82 figures.

Germer, R. 1993. Ancient Egyptian pharmaceutical plants and the Eastern Mediterranean. *In:* I. Jacob and W. Jacob (eds.): The Healing Past. E. J. Brill, Leiden. pp.1–126.

Ikram, S. and A. Dodson. 1998. The mummy in ancient Egypt. Thames and Hudson, London. pp.1–352.

König, R. 1983. C. Medizin und Pharmakologie: Heilmittel aus dem Pflanzenreich. In: Plinius Secundus der Ältere. Naturkunde Lateinisch–Deutsch. Vol. 26. Artemis Verlag München, Zürich. pp.25–27.

Lindley, J. 1838. Flora Medica. London. pp.1–655.

Lindsay, W.L. 1856. A popular history of British lichens. J. E. Taylor, London. pp.1–352.

Miller, C. 2000. Dictionary of Canadian Biography Online. University of Toronto/Universite Laval, Library and Archives Canada. http://www.biographi.ca/EN/ShowBio.asp?BioID=41882&query=poe

Monck, C.S.V. 1862. Statutes of the Province of Canada. Stewart Derbishire & George Desborats, Quebec. pp.1–290.

Natural History Society of Montreal. 1859. Constitution and By–Laws of the Natural History Society of Montreal, with the amending Act, 20th vict., ch. 118. John Lovell, Montreal. pp.1–31.

Natural History Society of Montreal. 1881. Natural History Society Proceedings. The Canadian Naturalist and Geologist, 10: 105–122.

Nova Scotia Museum. 2008. Sir J. William Dawson. http://museum.gov.ns.ca/fossils/finders/dawson.htm

Perez–Llano, G.A. 1944. Lichens – Their biological and economic significance. Botanical Review, 10: 1–65.

Pfister, D.H. 1982. Introducing the Farlow… Newsletter of the Friends of the Farlow, 1: 1–3.
Poucher, W.A. 1936. Perfumes, Cosmetics and Soaps, Vol. 1. D. Van Nostrand Company, New York. pp.1–439.
Richardson, D.H.S. 1974. The vanishing lichens; their history, biology, and importance. Hafner Press, New York. pp. 1–439.Seaward, M.R.D. and H.J.M. Sipman. 2006. An updated checklist of lichenized and lichenicolous fungi for Egypt. Willdenowia, 36: 537–555.

Opuscula Philolichenum, **6**: 51–54. 2009.

Opegrapha moroziana (Roccellaceae, Lichenized Ascomycetes), a new sorediate saxicolous species from eastern North America

James C. Lendemer[1]

ABSTRACT. – *Opegrapha moroziana* is described as new to science based on material from eastern North America (Georgia, North Carolina). The species is unusual for the combination of saxicolous habit, presence of soralia, and the production of psoromic acid in the thallus.

Introduction

During the last year I have had the opportunity to examine undetermined collections of lichens from the southern Appalachians in the herbarium of the New York Botanical Garden (NY). Many of these collections were made in the early 20th century and have remained undetermined because they belong to taxonomically difficult groups or were considered to represent potentially undescribed taxa for which there was not adequate material to describe. The last century has seen considerable progress in the field of lichen taxonomy and systematics, as well as lichen floristics of the southern Appalachians, and it is this accumulated knowledge that has made identification of many of these problematic specimens possible. Among the material I have examined at NY is a curious sorediate saxicolous crust collected by A.T. Beals in North Carolina probably in 1924. The photobiont of the collection was *Trentepohlia*, indicating probable placement in the Roccellaceae. Further study revealed the presence of minute, short lirelliform ascomata indicating placement in *Opegrapha* Ach., as well as an additional sterile collection from northern Georgia made by Sean Beeching in 2006. Comparison of the material with other saxicolous species of *Opegrapha* revealed it to represent a new species, which is formally described here as *Opegrapha moroziana* Lendemer.

The present description of *O. moroziana* further adds to our growing knowledge of the lichen biota of the southern Appalachian Mountains of eastern North America. Recent years have seen the description of a number of new taxa and reports of disjunct populations of tropical taxa (Harris & Ladd 2008; Lendemer 2007, 2007a; Lendemer & Harris 2007; Lendemer et al. 2007, 2008; Lücking et al. 2007; Lendemer & Sheard 2006; Lendemer & Tripp 2008; Sheard et al. 2008; Tønsberg 2007). Hopefully the description of *O. moroziana* will spur others to search for this taxon and further expand our knowledge of its ecological requirements and geographic distribution.

Materials and Methods

Measurements of the apothecia were made dry with a Baush & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water with an Olympus BX51 compound microscope and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. Illustrations were prepared using Adobe Photoshop. Sections of the thallus and apothecia, as well as mounts of the soredia were prepared by hand cutting with a razor blade and mounted in water. Measurements are based on water mounts prior to the application of reagents (10% KOH, or I). Chromatography was performed using solvent C following the standardized methods of Culberson and Kristinsson (1970). Chemical reagents are referred to under their standard abbreviations (e.g. K for KOH) and polarizing light is abbreviated "POL".

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The New Species

Opegrapha moroziana **Lendemer sp. nov.**
Mycobank #512897.

Opegrapha moroziana; species saxicola soraliis excavatis irregularibus, ascomatis ellipsoideis vel breviter fusiformibus, ascosporis 3-septatis et acidum psoromicum continenti distincta.

Type: **U.S.A. NORTH CAROLINA**. AVERY CO.: Grandfather Mountain, 1924?, *A.T. Beals s.n.* (NY, holotype).

Description. – **Thallus** saxicolous, sorediate, crustose, thin, continuous to cracked, chocolate brown to light brown at margins, epruinose, ca. 200 µm thick although often much thinner, +/-ecorticate and poorly stratified with vertical columns of photobiont cells interrupting a weakly defined cortex and medulla composed of highly gelatinized fungal hyphae; **prothallus** black, short/thin; **soralia** excavate, rounded, spreading and becoming confluent, 0.1-0.3 mm diam.; **soredia** small, (21) –27– (38) µm diam., with a single algal cell at the core, surrounded by a layer of fungal hyphae densely coated with crystals (POL+, K–); **photobiont** *Trentepohlia*, cells subglobose to ellipsoid or ovoid, often tapering to one end, (21) –32– (27) x (13) –16– (18) µm. **Apothecia** short lirelliform to apothecioid, solitary, sessile and fully raised above the thallus, unbranched and undivided, ellipsoid to short fusiform, with length to with ratio of ~ 2:1, 0.4–0.6 x 0.2–0.3 mm; **disc** exposed, epruinose; **lips** divergent, well developed, often radially fissured; **exciple** brown-black, carbonized fully below the hypothecium, 45–60 µm thick, dark brown-green in K, hyphae not differentiated; **hypothecium** thin, poorly differentiated, hyaline; **epihymenium** hyaline, K–; **hymenium** hyaline, not inspersed, I+ persistent blue, 60–120 µm; **asci** clavate, with 8 irregularly arranged ascospores, *vulgata*-type; **ascospores** hyaline, fusiform, 3-septate (4 celled), with an indistinct gelatinous sheath, (18.8) –19.7– (20.6) x (5.6) –7.4– (7.5) µm. **Pycnidia** not seen.

Chemistry. – Psoromic acid. Spot tests: K– or K+ dirty yellowish, C–, KC–, P+ yellow, UV–.

Etymology. – I am pleased to name this distinctive species in honor of my friend and partner Andrei Moroz who has accompanied me on many collecting trips throughout the Appalachian Mountains of eastern North America.

Ecology and distribution. – *Opegrapha moroziana* is a rare species presently known only from the southern Appalachians of eastern North America. It is confined to fine grained HCl- sandstones.

Discussion. – Saxicolous species of *Opegrapha* are rare in eastern North America and, among the few that have been reported, *O. moroziana* is distinctive in having a sorediate thallus and producing psoromic acid. Two sorediate saxicolous species of *Opegrapha* that could be confused with the new taxon are *O. gyrocarpa* Flot. and *O. zonata* Körber. These are best separated by their chemistry (gyrophoric acid [C+ pink, UV–] and confluentic acid [C–, UV+ blue-white] respectively). *Opegrapha zonata* also differs from *O. moroziana* in having an exciple that is weakly to non-carbonized in the lower portions and 5–7 septate ascospores.

The saxicolous habit, thin and continuous to cracked thallus, I+ blue hymenium, and chemistry of *O. moroziana* are highly suggestive of the genus *Lecanographa* Egea & Torrente. However, following Egea and Torrente (1994), *O. moroziana* is better placed in *Opegrapha* because of its epruinose apothecia, ascus type, and exciple that lacks differentiated hyphae and turns greenish-brown in KOH.

Additional specimen examined. – **U.S.A. GEORGIA**. DADE CO.: Cloudland Canyon State Park, ~0.5 mi E of Rt. 136, rim trail behind cabins, on sandstone, 15.x.2006, *S.Q. Beeching s.n.* (NY).

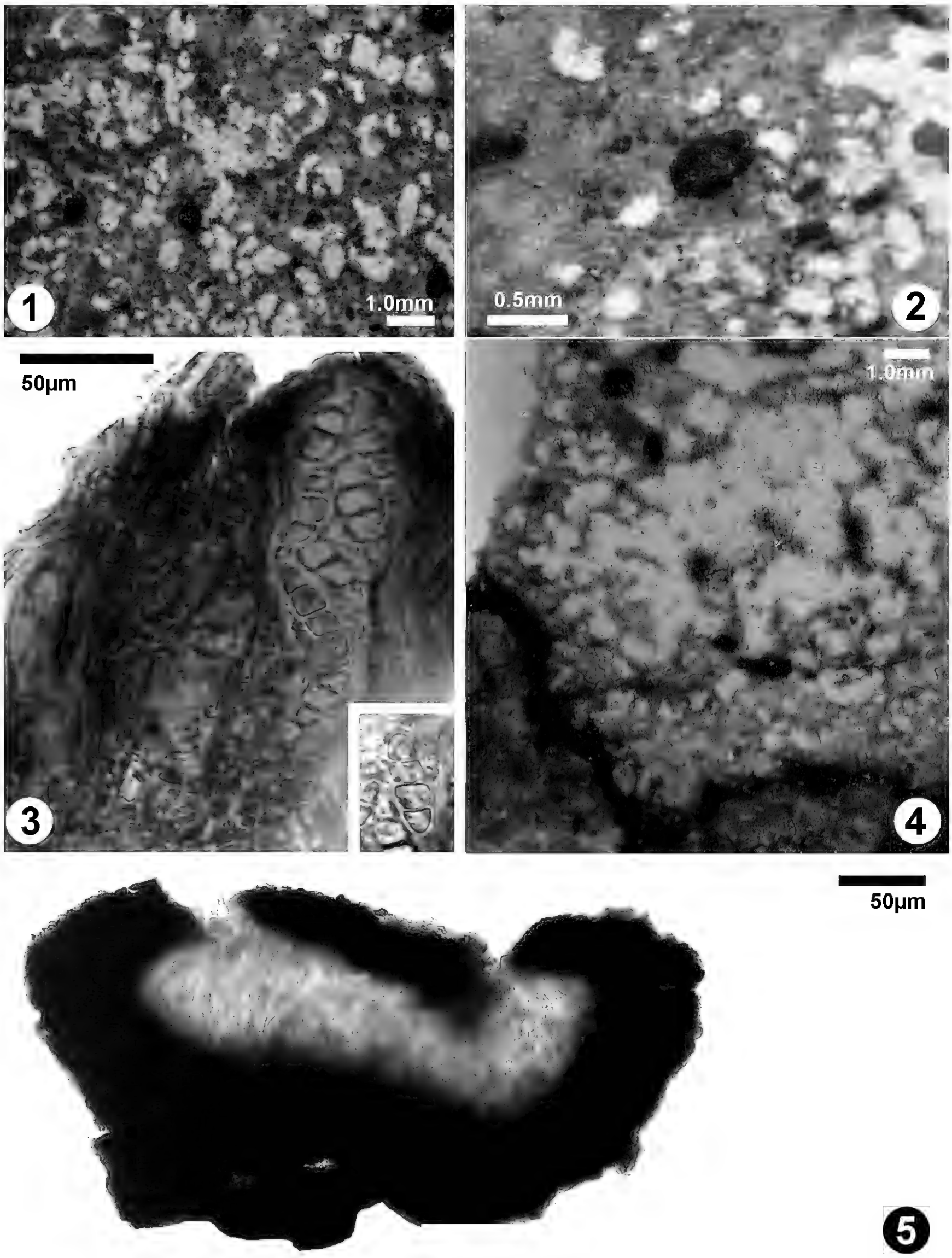

Plate 1. Thallus, ascomata, and asci of *Opegrapha moroziana* (all from holotype). Figure 1, thallus with soralia and apothecia. Figure 2, detail of apothecium. Figure 3, hymenium and ascus in I, with detail of ascospore inset (both = same scale). Figure 4, edge of thallus showing thin black prothallus. Figure 5, section of apothecium.

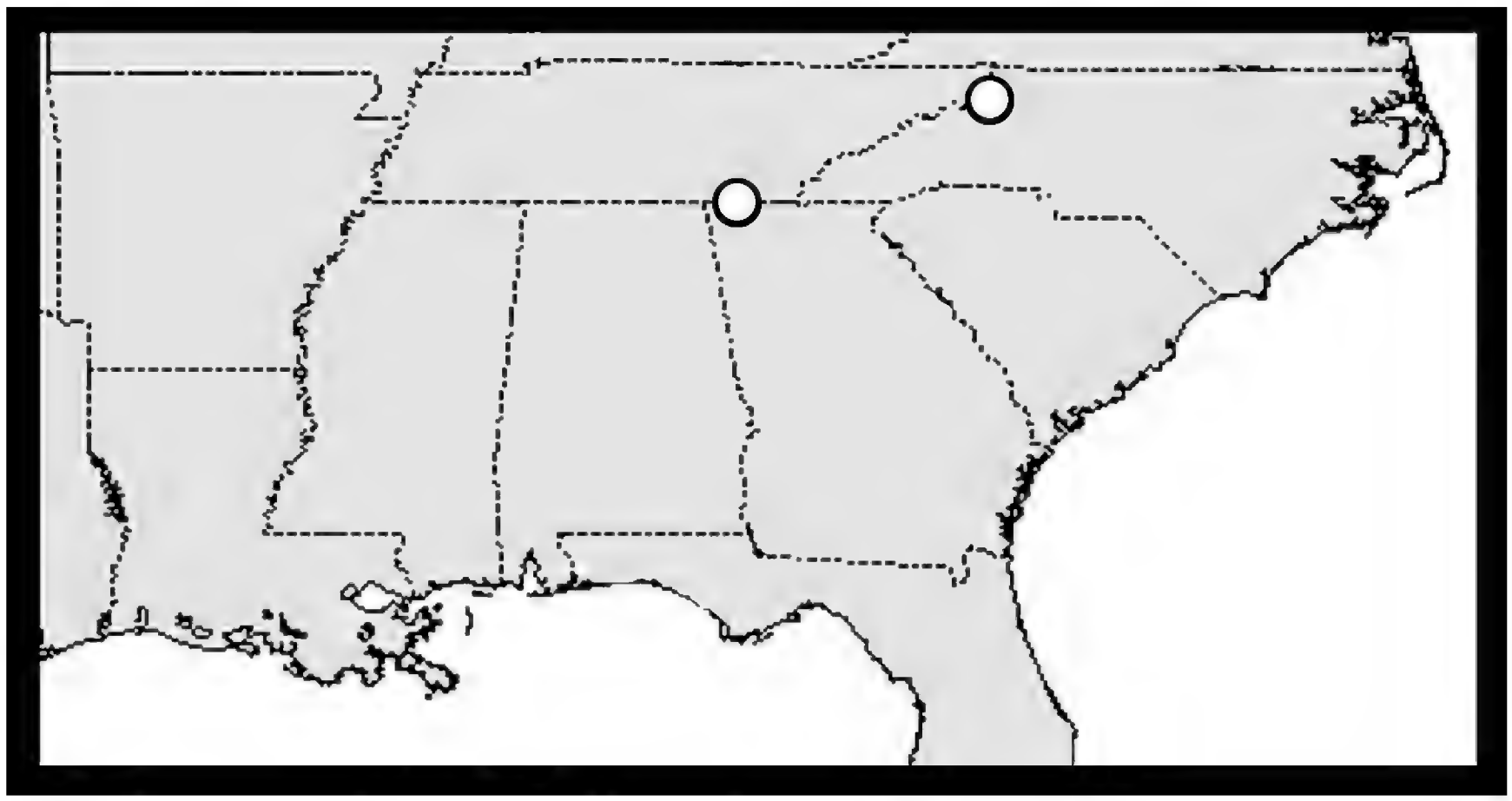

Plate 2. Known geographic distribution of *Opegrapha moroziana*.

Acknowledgements

Special thanks to Sean Beeching for sending the sterile specimen from Dade County, and to Damien Ertz, Richard Harris, and Laurens Sparrius for helpful discussion. Thanks also to Ernie Brodo, John Guccion, and Brendan Hodkinson for help in attempting to locate additional specimens of *Opegrapha moroziana*.

Literature Cited

Culberson, C.F., and H Kristinsson. 1970. A standardization methods for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Egea, J.M., P. Torrente. 1994. El Género de Hongos Liquenizados *Lecanactis* (Ascomycotina). Bibliotheca Lichenologica, 54, J. Cramer, Berlin & Stuttgart. 205 pp.

Harris, R.C. and D. Ladd. 2008. The lichen genus *Chrysothrix* in the Ozark Ecoregion, including a preliminary treatment for eastern and central North America. Opuscula Philolichenum, 5: 29–42.

Lendemer, J.C. 2007. *Megalaria beechingii* (lichenized Ascomycota), a new species from eastern North America. Opuscula Philolichenum, 4: 39–44.

Lendemer, J.C. 2007a. Contributions to the Lichen Flora of North Carolina: New and Interesting Reports. Evansia, 24(4): 98–102.

Lendemer, J.C. and R.C. Harris. 2007. *Lepraria normandinoides*, a new widespread species from eastern North America. Opuscula Philolichenum, 4: 45–50.

Lendemer, J.C., R.C. Harris, and J.A. Elix. 2008. *Pertusaria appalachensis*, a new species from North America. Opuscula Philolichenum, 5: 77—82.

Lendemer, J.C., R.C. Harris, and E.A. Tripp. 2007. *Heterodermia neglecta* (Physciaceae), a new lichen species from eastern North America. Bryologist, 110(3): 490–493.

Lendemer, J.C., and J.W. Sheard. 2006. The typification and distribution of *Rinodina chrysomelaena* (Physciaceae), a rare eastern North American lichen. Bryologist, 109(4): 562–565.

Lendemer, J.C., and E. Tripp. 2008. Contributions to the Lichen Flora of North Carolina: A Preliminary Checklist of the Lichens of Gorges State Park. Bryologist, 111(1): 4–67.

Lücking, R., W.R. Buck, and E.R. Plata. 2007. The lichen family Gomphillaceae (Ostropales) in eastern North America, with notes on hyphophore development in *Gomphillus* and *Gyalideopsis*. Bryologist, 110(4): 622–672.

Sheard, J.W., J.C. Lendemer, and E. Tripp. 2008. *Buellia japonica* (Physciaceae, lichenized Ascomycetes), a new report for North America. The Bryologist, 111(1): 124–127.

Tønsberg, T. 2007. Notes on the Lichen Genus *Lepraria* in Great Smoky Mountains National Park, southeastern North America: *L. lanata* and *L. salazinica* spp. nov. Opuscula Philolichenum, 4: 51–54.

Opuscula Philolichenum, **6**: 55–58. 2009.

Pertusaria andersonii (Pertusariaceae, Lichenized Ascomcyetes), a new species from high elevations of the southern Appalachian Mountains in eastern North America

James C. Lendemer[1]

ABSTRACT. – *Pertusaria andersonii* is described as new to science. The species is characterized by its saxicolous habit, isidiate thallus, monosporous asci, and the production of fumarprotocetraric acid.

Introduction

Historically, the study of isidiate and sorediate crustose lichens in North America has been hindered by a lack of adequate collections. In recent decades increased collecting efforts throughout the continent have resulted in the discovery of numerous new and interesting taxa (e.g. Kalb 2004; Harris & Ladd 2008; Lendemer 2007; Printzen & Tønsberg 2003, 2007; Wetmore 2004), several of which have been described based on material from the southern Appalachian Mountains of eastern North America. Recently, while reviewing undetermined specimens of isidiate crustose lichens in the herbarium of The New York Botanical Garden (NY), I came across a specimen from North Carolina, USA that was identified as *Pertusaria* cf. *stalactiza* Nyl. The material did not represent a taxon with which I was familiar, and the name did not currently appear on the North American Checklist (Esslinger 2008). As such, I compared the collection to specimens of *P. stalactiza* from Europe and this comparison revealed the North American material to be distinct. Subsequent searches of the undetermined material at NY revealed an additional sterile collection of the same taxon from Virginia, USA. As part of the continuing studies of southern Appalachian lichens, these collections are formally described here as *Pertusaria andersonii*.

Materials and Methods

Specimens were studied dry using a Baush & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water with an Olympus BX51 compound microscope and images were captured using an Olympus DP20 digital camera with Microsuite Special Edition. Illustrations were prepared using Adobe Photoshop. Sections of the thallus and apothecia were prepared by hand cutting with a razor blade and mounted in water. Measurements are based on water mounts prior to the application of 10% KOH. Chromatography was performed using solvents C and G following the standardized methods of Culberson and Kristinsson (1970).

The New Species

***Pertusaria andersonii* Lendemer sp. nov.**

Mycobank #512899.

Pertusariae stalactizae similis, sed isidiis grandioribus, et dispersus.

Type: **U.S.A. NORTH CAROLINA**. AVERY CO.: Grandfather Mountain, 1936, *G.P. Anderson s.n.* (NY, holotype).

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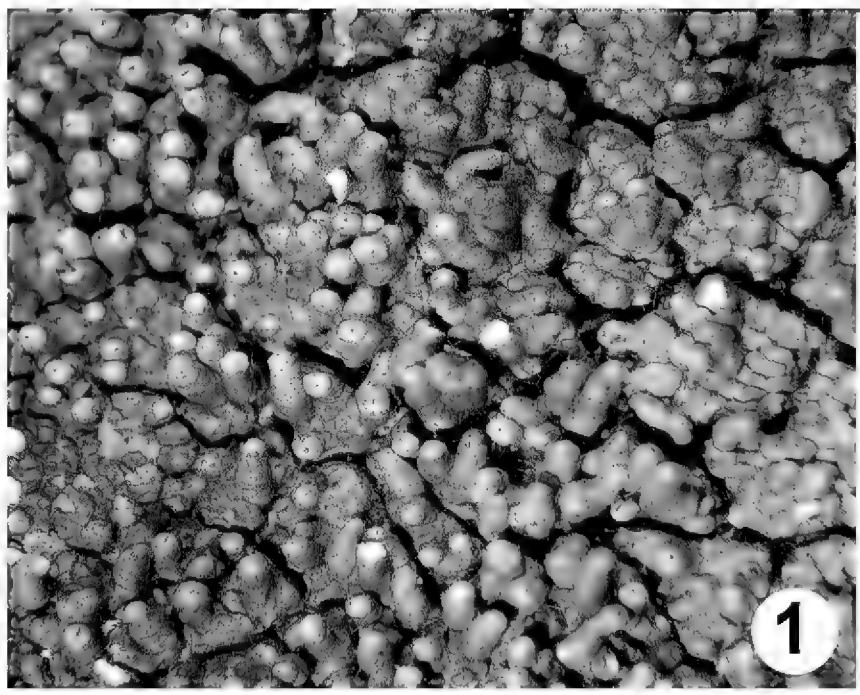

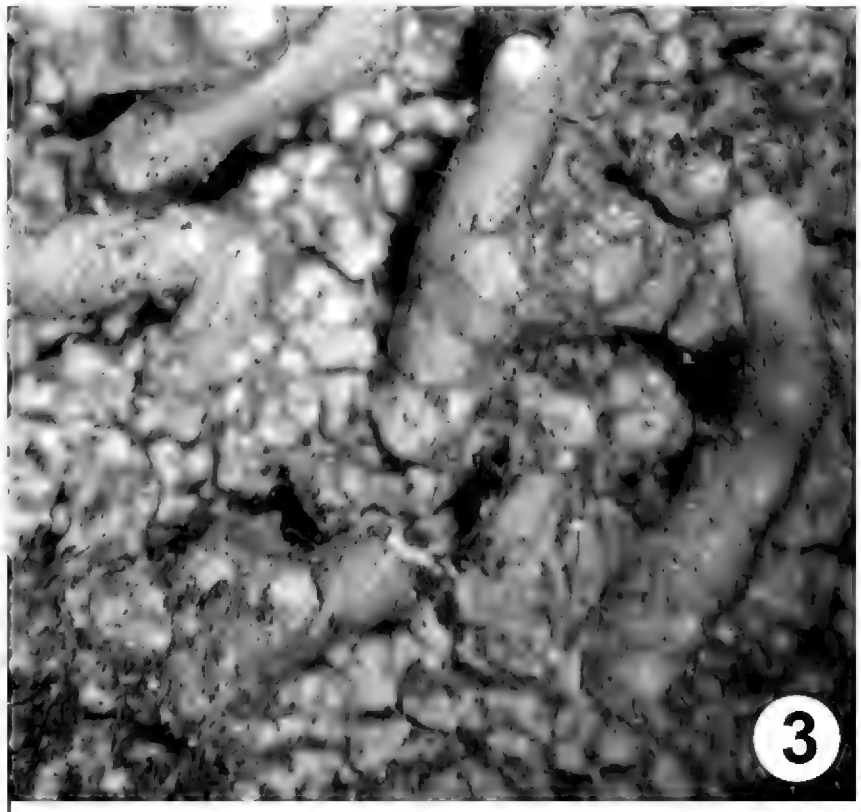

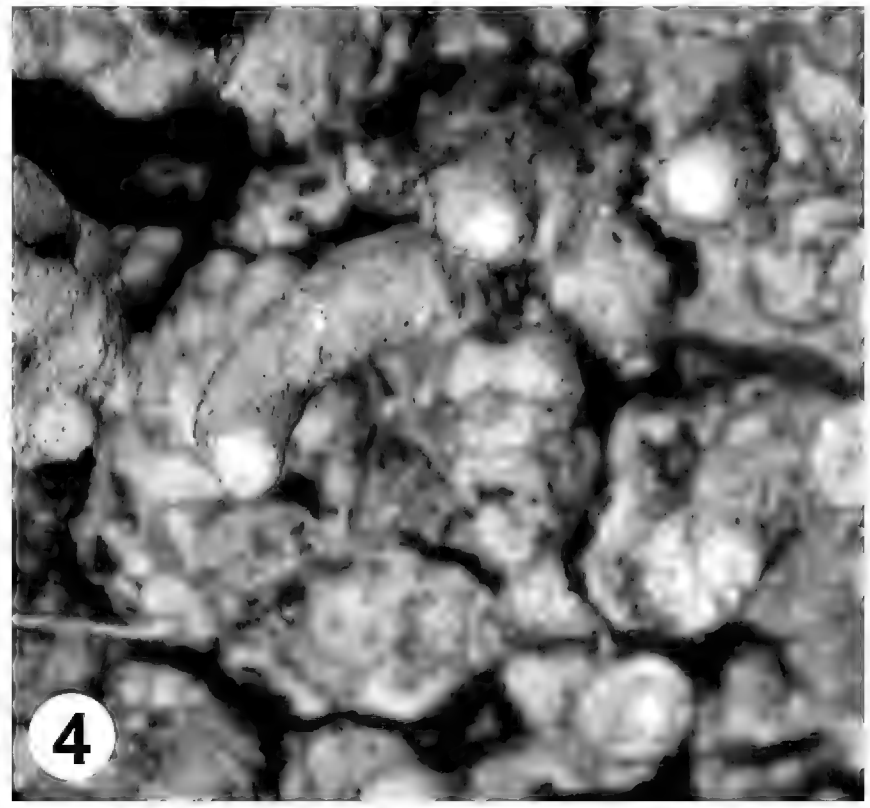

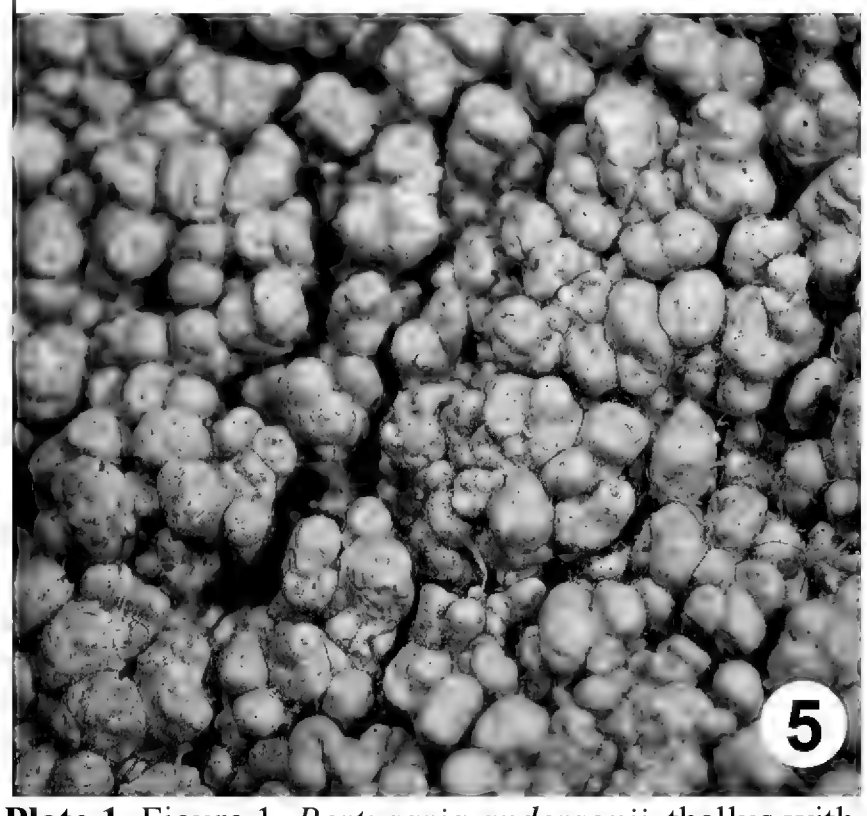

Plate 1. Figure 1, *Pertusaria andersonii*, thallus with isidia (paratype, 10x). Figure 2, *P. andersonii*, detail of apothecia (holotype, 20x). Figures 3–4, *P. andersonii*, detail of isidia (holotype, 20x). Figure 5, *P. stalactiza*, thallus with isidia (10x). Figure 6, *P. andersonii*, ascospores (scale = 100µm).

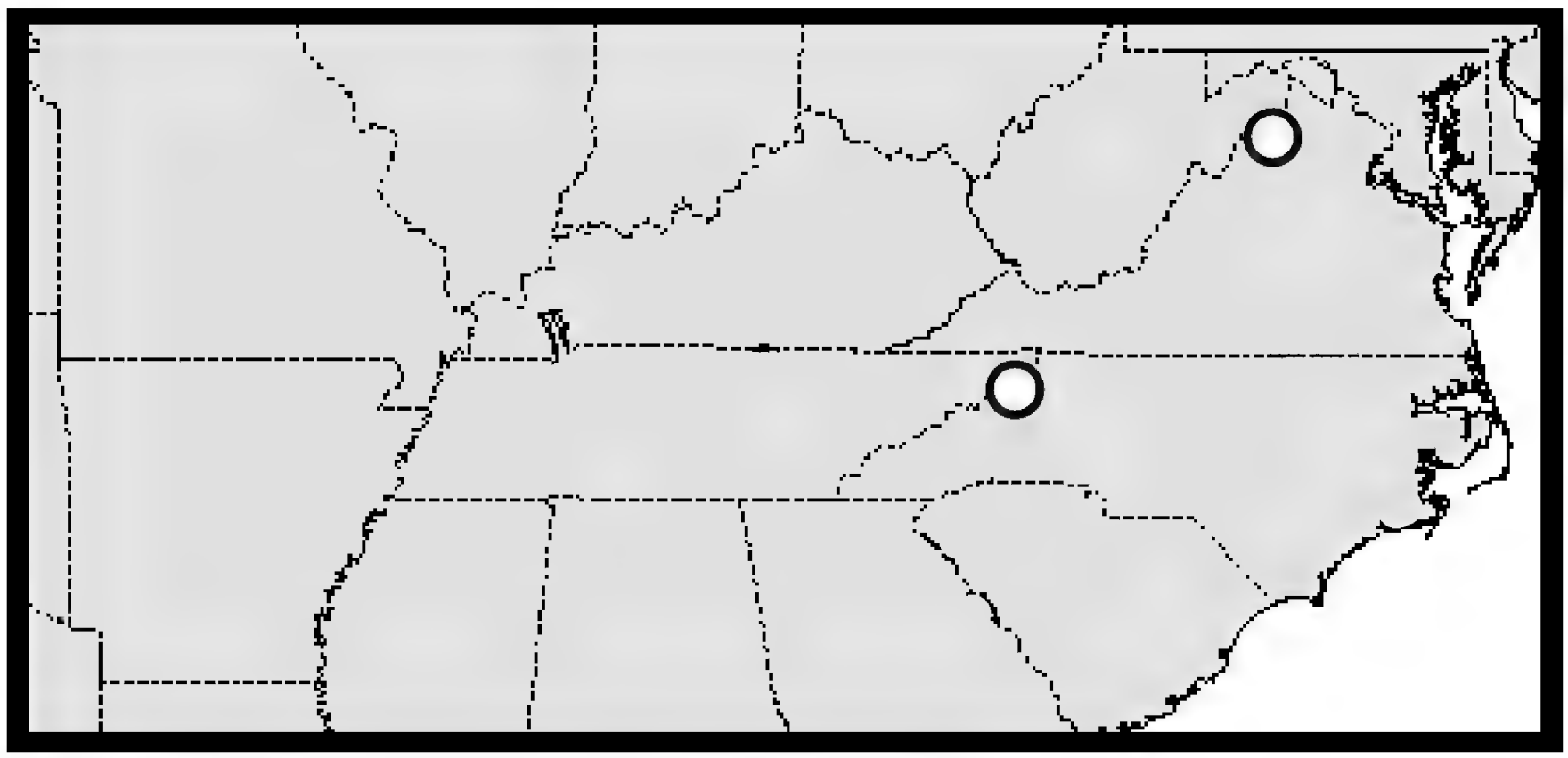

Plate 1. Known geographic distribution of *Pertusaria andersonii*.

DESCRIPTION. – **Thallus** saxicolous, blue–gray to ash–gray, shiny to somewhat dull centrally, continuous and thin marginally to thick and cracked/rimose–areolate centrally, isidiate; **isidia** dispersed +/– evenly on thallus, often arising near cracks, cylindrical, tall, with poorly corticate white tips; **apothecia** *Variolaria*–type, discoid, not borne directly on the isidia but arising on the thallus independent of them, discs pruinose; **epihymenium** blue–black, covered with dense crystals of pruina; **hymenium** hyaline, 90–120 µm tall; **hypothecium** hyaline, 120–150 µm thick; **ascospores** 1/ascus, single–walled, hyaline, smooth, (114)–125–(138) x (41)–46–(51) µm.

CHEMISTRY. – Cortex: atranorin. Medulla: fumarprotocetraric acid (major), protocetraric acid (minor). Spot tests: C–, K+ yellowish–brown, KC–, P+ orange/red, UV–.

ETYMOLOGY. – The epithet "andersonii" honors the collector of the type, Gladys P. Anderson (1888–?), a North American lichenologist active in the early 20th century whose work has largely been overlooked and forgotten. Her keen collecting abilities contributed greatly to our knowledge of eastern North American lichens, especially from the southern Appalachians and her unprocessed collections continue to yield unexpected surprises such as the taxon newly described herein.

ECOLOGY AND DISTRIBUTION. – *Pertusaria andersonii* is presently known only from high elevations of the southern Appalachians (North Carolina and Virginia, USA). The species occurs on granite, the dominant rock type in the region. Despite being a conspicuous taxon, the species does not appear to have been collected since 1936.

GENERIC PLACEMENT. – Although *Pertusaria andersonii* clearly belongs to the genus *Pertusaria* DC. as presently circumscribed, the genus has shown to be polyphyletic (Schmitt & Lumbsch 2004). As is discussed below the new species is related to *P. dactylina* and thus belongs to the *Variolaria* (*Monomurata*) group (*sensu* Schmitt and Lumbsch (2004)) which will likely be segregated as a distinct genus in the future.

DISCUSSION. – Among the saxicolous isidiate crustose lichens known from eastern North America *Pertusaria andersonii* is distinctive because of the production of fumarprotocetraric acid. Morphologically the species could be confused with *Ochrolechia yasudae* (Vainio) Oshio or *Pertusaria globularis* (Ach.) Tuck., however in neither of these taxa are the isidia white tipped.

Within the genus *Pertusaria*, only *P. dactylina* and *P. stalactiza* produce isidia and fumarprotocetraric acid. *Pertusaria dactylina* is a common species occurring on organic matter and humus

in arctic–alpine regions and is distinguished from *P. andersonii* and *P. stalactiza* in having the apothecia borne directly on the tips of the isidia and bi–sporous rather than mono–sporous asci. *Pertusaria stalactiza* is most similar to *P. andersonii* because it also has mono–sporous asci and occurs on non–calcareous rocks. The species is however, known only from central Europe, and differs markedly from *P. andersonii* in thallus morphology. The isidia of *P. stalactiza* are short, blunt, not white tipped, and are densely aggregated giving the thallus an irregular bumpy continuous appearance (see figures herein). In contrast, the isidia of *P. andersonii* are tall, cylindrical, white tipped, and are dispersed on a thick continuous to rimose–areolate thallus. Though the isidia of *P. andersonii* resemble those of *P. dactylina* the apothecia are borne on the tips of the isidia in *P. dactylina* rather than directly on the thallus. In addition to the position of the apothecia, the bisporous asci and the terricolous/muscicolous habit readily distinguish *P. dactylina* from *P. andersonii*.

Additional specimen examined. – **U.S.A. VIRGINIA**. PAGE CO.: Hawksbill Mountain, 8.vi.1935, *G.P. Anderson s.n.* (NY).

Comparative Material of *Pertusaria stalactiza* examined. – **TRANSYLVANIA [ROMANIA].:** in saxis micaceos–schistosis vallis dictae "Riusov" infra montem Retyczat, *Lojka s.n.* = *Flora Exsiccata Austro–Hungarica 2359* (NY, 2 specimens).

Acknowledgements

Special thanks to Alan Archer and Imke Schmitt for reviewing the manuscript. Thanks to Alan Archer for discussion of this, and other, *Pertusaria* problems. Also to Richard Harris for discussions and help with the Latin diagnosis.

Literature Cited

Culberson, C.F., and H Kristinsson. 1970. A standardization methods for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Esslinger TL. 2008. A cumulative checklist for the lichen–forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm (First Posted 1 December 1997, Most Recent Update 18 January 2008), Fargo, North Dakota.

Harris, R.C., and D. Ladd. 2008. The lichen genus *Chrysothrix* in the Ozark Ecoregion, including a preliminary treatment for eastern and central North America. Opuscula Philichenum, 5: 29–42.

Kalb, K. 2004. New or otherwise interesting lichens II. *In:* Döbbeler, P, and G. Rambold (eds.): Contributions to Lichenology. Festschrift in Honour of Hannes Hertel. Bibliotheca Lichenologica, 88: 301–329.

Lendemer, J.C. 2007. *Megalaria beechingii* (lichenized Ascomycota), a new species from eastern North America. Opuscula Philolichenum, 4: 39–44.

Printzen, C., and T. Tønsberg. 2003. Four new species and three new apothecial pigments of *Biatora*. *In:* Jensen, M (ed.): Lichenological Contributions in Honour of G. B. Feige. Bibliotheca Lichenologica, 86: 133–145.

Printzen, C., and T. Tønsberg. 2007. *Bacidia lobarica* (Bacidiaceae, Lecanorales) sp. nov., a sorediate lichen from the southeastern U.S.A. The Bryologist, 110(3): 487–489.

Schmitt, I. and H.T. Lumbsch. 2004. Molecular phylogeny of the Pertusariaceae supports secondary chemistry as an important systematic character set in lichen–forming ascomycetes. Molecular Phylogenetics and Evolution, 33: 43–55.

Wetmore, C.M. 2004. The sorediate corticolous species of *Caloplaca* in North and Central America. The Bryologist, 107(4): 505–520.

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Naetrocymbe herrei (Pleosporales; Ascomycetes), a new lichenized saxicolous species from the coast of central California, U.S.A.

KERRY KNUDSEN[1] & JAMES C. LENDEMER[2]

ABSTRACT. – *Naetrocymbe herrei* is described as new to sciences based on several collections from California in western North America.

KEYWORDS. – *Arthopyrenia*, global warming, maritime lichens, rising sea levels.

INTRODUCTION

During a recent survey of the lichens and lichenicolous fungi of San Simeon State Park, San Luis Obispo Co., California, the first author collected abundant material of what appeared to be a saxicolous species of *Arthopyrenia* A. Massal. growing on rocks below a coastal bluff. After further study failed to reveal a name for the taxon, we contacted Richard Harris who has worked extensively with this and other closely related genera (Harris 1973, 1985, 1995; Tucker & Harris 1980). Harris examined a specimen of the taxon and recognized it as *Arthopyrenia* "*herrei*" a species named in his thesis but for which a validating description has never been published due to a lack of modern material. As our recent collections are more than ample to serve as a type, Dr. Harris has given us permission to formally describe this distinctive species that is so far known only from central California.

In the time that has elapsed since this taxon was originally recognized by Harris (1975), the circumscription of *Arthopyrenia* has changed significantly (Harris 1995). In its historical sense *Arthopyrenia* was circumscribed to include lichenized and non–lichenized fungi with perithecia and bitunicate asci (Ravera 2006). Harris (1995) attempted to make *Arthopyrenia* monophyletic by transferring several groups of species to other genera (and families). Among the groups excluded from *Arthopyrenia* was the *A. punctiformis/A. saxicola*–group which is characterized by a usually non–lichenized habit, coarse, short–celled pseudoparaphyses, obpyriform asci with a distinct apical region lacking a nasse, postmature ascospores usually ornamented, brownish, short rod–shaped microconidia, and a primarily temperate–boreal distribution (Harris 1995). The *A. punctiformis/A. saxicola*–group was placed by Harris (1995) in the genus *Naetrocymbe* Körber in the family Naetrocymbaceae Höhnel *ex* R.C. Harris, a placement which has been followed by most authors (e.g. Lumbsch & Huhndorf 2007, Cannon & Kirk 2007), but not all (e.g. Aptroot 1998, Coppins 2002).

As *Arthopyrenia "herrei"* possesses all of the characters recognized by Harris (1995) for placement in *Naetrocymbe*, except for the lichenized nature of the thallus and ornamented ascospores, we place this species is in that genus. Nonetheless we recognize that in the future *Naetrocymbe herrei* may need to be transferred to a new genus as a robust molecular phylogeny of this lineage of fungi is developed and new systematic and taxonomic progress is made. We have deposited adequate fresh material of this taxon in several American (NY, UCR) and European herbaria (BR, PRM) to allow for future molecular studies.

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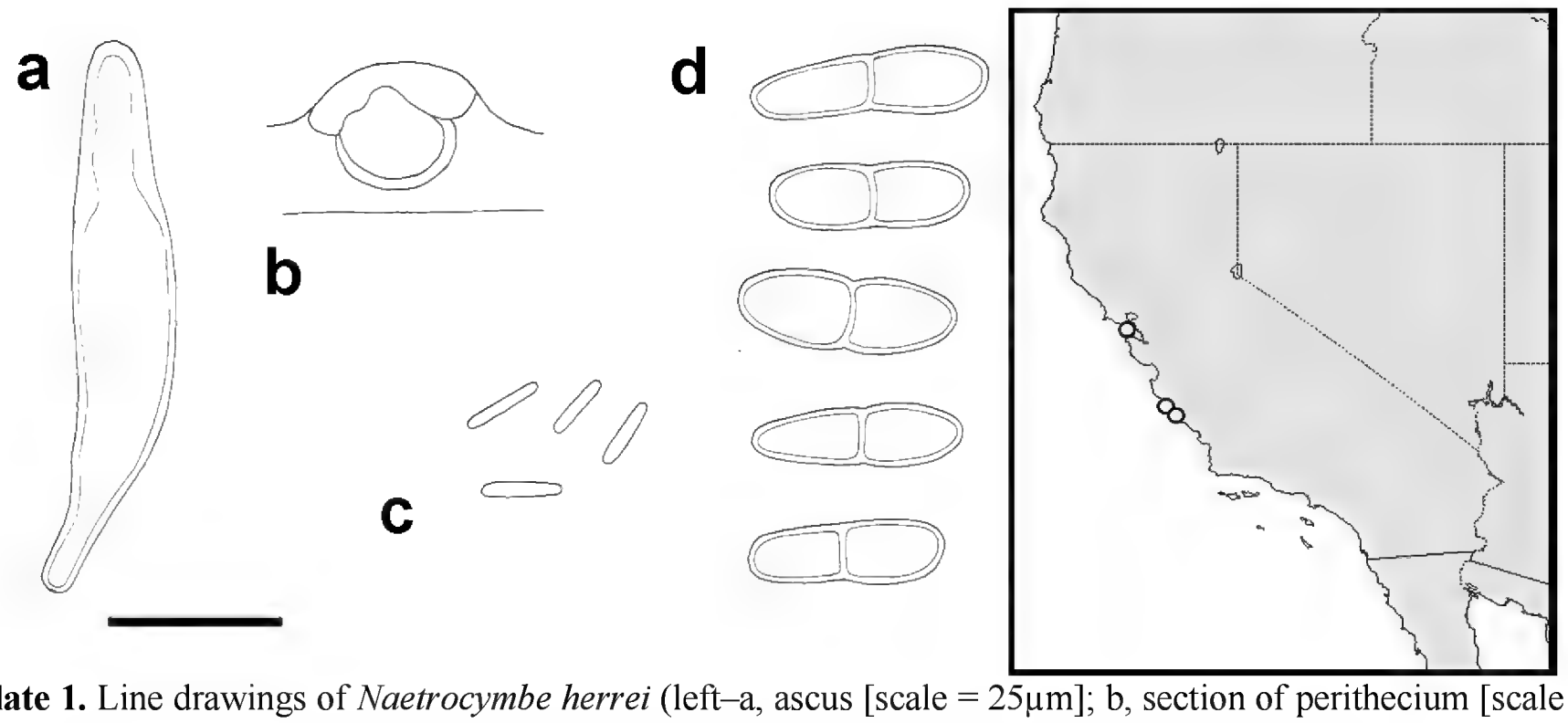

Plate 1. Line drawings of *Naetrocymbe herrei* (left–a, ascus [scale = 25µm]; b, section of perithecium [scale = 250µm]; c–d, conidia and ascospores [scale = 10µm], drawn from *Herre 889*). Geographic distribution of *N. herrei* as presently known (right).

The anomalous nature of this taxon in the broader context of the genus *Naetrocymbe* is significant because it may represent a transitional state between the loss of, or gain of, lichenization. The relevance of this taxon to the phylogeny of this lineage of fungi should not be underestimated. And this, coupled with the apparent fact that it is rare and endemic to the Pacific Plate in central California, clearly necessitates the formal nomenclatural recognition of this taxon to facilitate its potential management by government agencies.

Materials and Methods

Thalli and perithecia were measured dry with a Bausch & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water with an Olympus BX51 microscope with an Olympus DP20 digital camera using Microsuite Special Edition. Photographs were taken with the same compound microscope, camera, and software outlined above and prepared in Adobe Photoshop. Sections of the perithecia were prepared by hand cutting with a razor blade and mounted in water. Measurements of anatomical characters, ascospores, and conidia are based on water mounts prior to the application of reagents (10% KOH, or I). Ascospore measurements are given as the average (Xbar) +/– one standard deviation (SD). Brilliant cresyl blue (Bcr) was used to stain structures. Specimens were studied with thin layer chromatography (TLC) using solvents C following the standardized methods of Culberson & Kristinsson (1970).

The New Species

***Naetrocymbe herrei* K. Knudsen & Lendemer sp. nov.**

Mycobank #512898.

Naetrocymbe thallo epilithico fusco *Trentepohliam* continenti, ascis gracilibus, 65–85 x 12–15–(20) µm et sporis parvis bicellularibus, (15.9) –18.8– (21.8) x (4.7) –5.8–(6.2) µm.

Type: **U.S.A. CALIFORNIA**. SAN LUIS OBISPO CO.: San Simeon State Park, north the elephant seal vista, steep rocky slope above cove, 35°39'49"N, 121°15'57"W, 7 m, on volcanic rock, 15.viii.2008, *K. Knudsen 10138* (NY, holotype; BR, PRM, UCR, isotypes.)

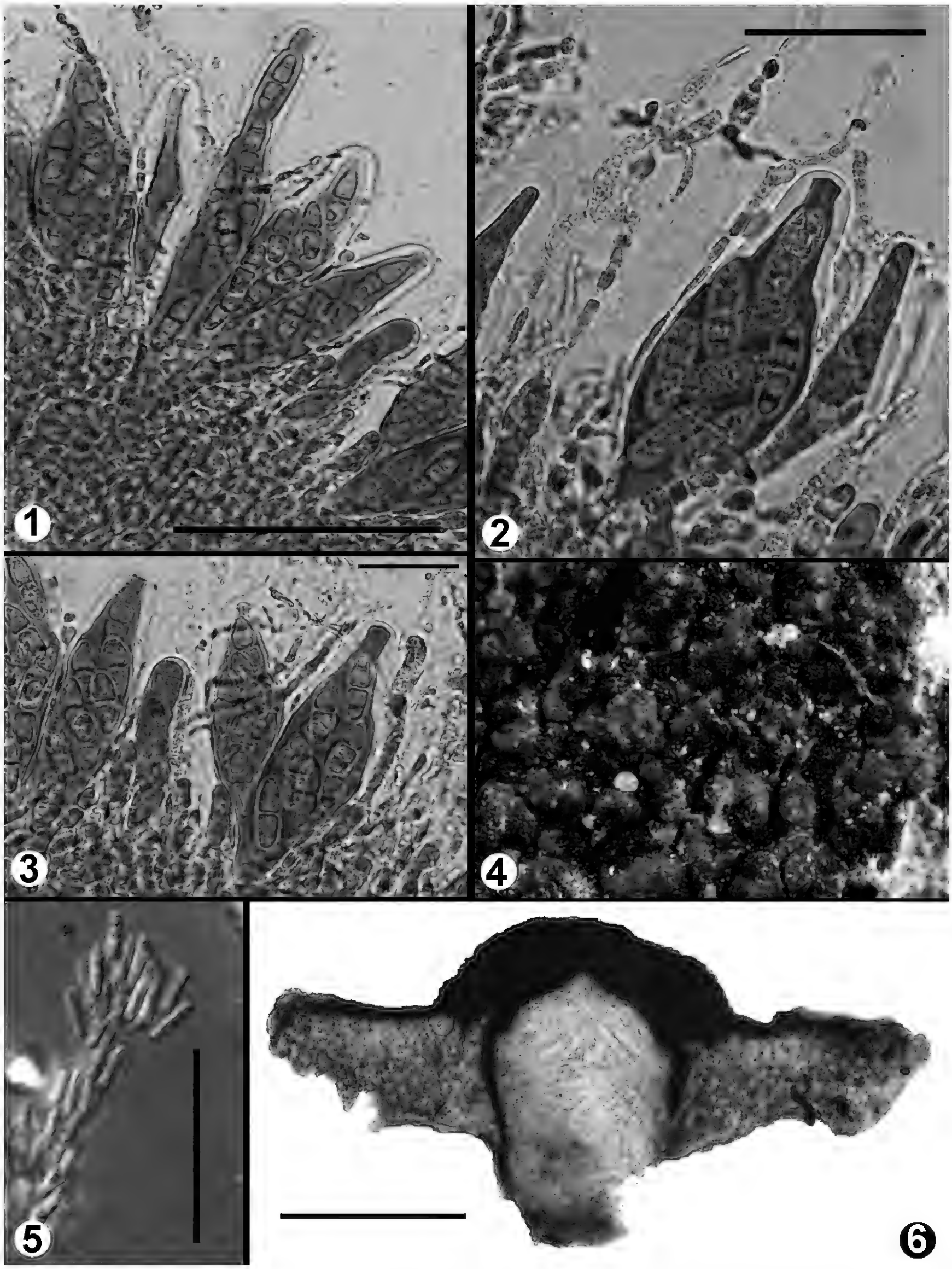

Plate 2. *Naetrocymbe herrei*, thallus, perithecia, and conidia (all from holotype, NY). Figure 1, squash preparation of hymenium (mounted in I, scale bar = 50µm). Figures 2–3, detail of ascus and pseudoparaphyses (mounted in I, scale bar = 20µm). Figure 4, thallus (20x). Figure 5, conidia (differential interference contrast, scale bar = 20µm). Figure 6, section of perithecium (scale bar = 200µm).

Description. – *Thallus* well developed, epilithic, brown to dark brown, matt, epruinose, thin (150–300 µm thick), areolate, well–developed areoles sometimes imbricate, gelatinous when wet, covering areas of up to 10 cm; *Areoles* with indistinct upper cortex formed by pigmented hyphae, and medulla formed of un–oriented gelatinized hyphae, inspersed with crystals, poorly stratified; *Photobiont Trentepohlia,* cells up to 15 µm long, filaments rudimentary, shortened and broken by lichenization; *Ascomata* perithecia, numerous, semi–immersed in areoles, subglobose, 0.2–0.3 mm diam., ostiole visible as depression; *Exciple* globose, 15–20 µm thick, apically slightly thicker, thinning at base, dark brown, usually hyaline at base; *Involucrellum* contiguous with upper half to two–thirds of exciple, spreading outward, 70–90 um thick, darkly pigmented, obscuring hyphae; *Periphyses* branched, 5–20 x 1–1.5 µm; *Hamathecium* with pseudoparaphyses present, distinct, non–gelatinized, irregular and branching, septate, 1.5–3 µm wide, cells 3–5 µm long, containing abundant small oil drops; *Asci* obpyriform, wall strongly thickened at apex, 65–85 x 12–15–(20) µm; ascospores hyaline, 1–septate, cells equal or upper cell slightly wider, (15.9)–18.8–(21.8) x (4.7)–5.8–(6.2) µm, perispore narrow and indistinct, not usually constricted, lacking ornamentation; *Conidiomata* pycnidial, globose, to 100 µm diam, abundant; *Conidiophores* mostly 10 x 1.5 µm; *Conidia* rod–like, 4–5 x 1µm; *Secondary metabolites*: none detected.

Chemistry. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

Etymology. – The specific epithet honors A.C.T.W. Herre (1868–1962), collector of the material that originally led Richard Harris to recognize this taxon as distinct.

Ecology and distribution. – *Naetrocymbe herrei* is presently only known from the type locality, where it is common in a small area of a rock slope above the cove, and at San Carpoforo Creek, a site approximately five miles farther north in San Simeon State Park in San Luis Obispo County, on the central coast of California. This species was originally collected by A.C.T.W. Herre in 1907 on Point Lobos in San Francisco, an area currently included in the Golden Gate National Recreation Area, which is administered by the National Park Service. It is not known if the species still occurs at this historic site. Also it is not known whether *N. herrei* is naturally rare or has just been undercollected. It occurs on volcanic rock, at elevations of 3–10 m or a little higher, above maximum high tide levels but exposed to salt spray. The species grows with *Caloplaca coralloides* (Tuck.) Hulting and *Verrucaria subdivisia* Breuss at the type locality. At San Carpoforo Creek it is growing in a well–developed maritime saxicolous community including *Caloplaca luteominia* (Tuck.) Zahlbr. var. *luteominia*, *Caloplaca stantonii* W.A. Weber ex Arup, *Dirina catalinariae* Hasse, *Lecania fructigena* Zahlbr., *Opegrapha brattiae* Egea & Torrente and *V. subdivisia.* In competition with other maritime species it was not dominant, but rather rare and occurring as small thalli that are easily overlooked. *Caloplaca coralloides* did not occur at the San Carpoforo Creek site which may indicate that this microhabitat is not best suited for *N. herrei*.

Discussion. – It is important to ascertain the current distribution of *Naetrocymbe herrei* and to determine if it is naturally rare. The effect of global warming on the maritime lichen biota of California (which has many rare and endemic species) is still unknown. *Naetrocymbe herrei* can tolerate salt spray, but so far has been collected above maximum high tide levels. Relatively rapid rising sea levels could have a drastic effect on intertidal lichens, which may not have time to transition to new intertidal positions. Upper littoral zone lichens like *N. herrei* (which may have been limited already by the relatively slow rise of sea levels at the end of the last ice age and are now probably naturally rare) may not be able to transition to new higher sites quickly enough to survive if sea levels rise too rapidly in the next century. It is still unclear what future sea levels will be and how fast they will rise.

In practical terms the dull thin brown thallus can be easily overlooked in the field, despite its prominent perithecia. However, at the two sites where *Naetrocymbe herrei* was collected it could not be confused with any other species.

Additional specimen examined. – **U.S.A. CALIFORNIA**. SAN FRANCISCO CO.: San Francisco, Point Lobos, 19.vii. 1906, *A.C.T.W. Herre 889* (FH, MICH, NY [2 specimens], US, and probably also F). SAN LUIS OBISPO CO.: San Simeon State Park, San Carpoforo Creek, south side of creek, north–facing slope between lagoon and beach, 35°43'49"N, 121°19'25"W, 3 m., rare on volcanic rock in mixed saxicolous community, 10.ix.2008, *K. Knudsen 10238* (UCR).

Acknowledgements

We thank Richard Harris for his generous help, guidance, assistance with the illustrations, and for providing the line drawings published herein. We also thank André Aptroot, Richard Harris, and Patrick McCarthy for reviewing the manuscript. We thank Mike Walgren and Lisa Andreano of San Simeon State Park for their hospitality. The first author thanks San Simeon State Park for financial support and Dr. J. Giles Waines, director of the UCR Herbarium. The second author also thanks Vinson Doyle for assistance with with the illustrations.

Literature Cited

Aptroot, A. 1998. Aspects of the integration of the taxonomy of lichenized and non–lichenized pyrenocarpous ascomycetes. The Lichenologist, 30: 501–514.

Cannon, P.F. and P.M. Kirk. 2007. Fungal Families of the World. Kyodo Press, Singapore. 456 p.

Coppins, B.J. 2002. Checklist of Lichens of Great Britain and Ireland. British Lichen Society. 87 pp.

Culberson, C.F., and H Kristinsson. 1970. A standardization methods for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Harris, R.C. 1973. The corticolous pyrenolichens of the Great Lakes region. Michigan Botanist, 12: 3–68.

Harris, R.C. 1975. A Taxonomic Revision of the Genus *Arthopyrenia* Massal. s. lat. (Ascomycetes) in North America. Michigan State University Ph. D. thesis, 288 pp.

Harris, R.C. 1985. Lichens of the New Jersey pine barrens collected on the seventh A. Leroy Andrews Foray, 1982. Evansia, 2: 44–47.

Harris, R.C. 1995. More Florida Lichens. Including the 10¢ Tour of the Pyrenolichens. Publ. by the Author, Bronx, N.Y. 192 pp.

Lumbsch, H.T. and S.M. Huhndorf (eds.). 2007. Outline of Ascomycota 2007. pp 1–58. (http://www.fieldmuseum.org/myconet/pdfs/Myconet_13a.pdf)

Ravera, S. 2006. Two new species of *Arthopyrenia* from Italy. The Lichenologist, 38(1): 21–26.

Tucker, S.C. and R.C. Harris. New or noteworthy pyrenocarpous lichens from Louisiana and Florida. The Bryologist, 83: 1–20.

Opuscula Philolichenum, **6**: 65–72. 2009.

Contributions to the Lichen Flora of North Carolina: A Preliminary Checklist of Lichens of the Uwharrie Mountains

Gary B. Perlmutter[1]

ABSTRACT. – A preliminary checklist of 78 species in 47 genera of lichens from 137 collections made in the Uwharrie Mountains of the North Carolina Piedmont is presented. Notewothy finds include *Mycoporum acervatum* and *Rinodina destituta* as new for North Carolina, and six new records for the North Carolina Piedmont. Among the latter is the rare *Xanthoparmelia monticola*, here first reported from outside its known range in the high elevation rock outcrops of the southern Appalachians.

Introduction

Approximately one third of North Carolina lies in the Piedmont physiographic province, an area characterized by rolling hills derived from ancient bedrock that is largely over 400 million years in age. The Piedmont is the most heavily populated region in the state, with three metropolitan areas involving the cities of Charlotte, Greensboro and Raleigh. Yet it still harbors many natural areas abounding with scenic rivers and lush deciduous forests.

One particularly noteworthy area within the North Carolina Piedmont is the Uwharrie Mountains, a narrow chain of peaks (150–300 m elevation) stretching southwest to northeast approximately 46 km in Stanly, Montgomery and Randolph counties. As summarized by Daniel and Butler (1996), the geology of this range was formed approximately 500 million years ago from eruptions by a chain of volcanic islands in shallow seas. Those volcanic rocks were later metamorphosed, folded and faulted, and finally exposed via erosion to form the chain of isolated peaks, known as monadnocks. The geology is largely metamorphic, complicated with a mixture of metavolcanic and mafic rocks in the northern half, and metasedimentary rocks with abundant metavolcanic rocks in the southern half of the chain.

As part of an ongoing effort to inventory the lichens of the North Carolina Piedmont (Perlmutter 2006, 2008, Perlmutter & Lendemer 2008), this report documents lichens found during two forays into the Uwharrie Mountains, a region that previously has received little if any attention lichenologically.

Study Area

On separate collecting forays three areas in the Uwharries were explored: Morrow Mountain State Park, Barnes Creek Bluffs in Uwharrie National Forest and The Nature Conservancy's Black Ankle Bog Preserve. Morrow Mountain State Park is in Stanly County, while the latter two areas are in Montgomery County (Fig.1). Descriptions of these areas are as follows.

Morrow Mountain State Park

Morrow Mountain State Park lies adjacent to the Pee Dee River in eastern Stanly County. The park covers 1920 ha of oak–hickory deciduous forest and its natural areas are listed as nationally significant (NC Natural Heritage Program 2008). Distinctive features include four monadnocks, the highest being Morrow Mountain at nearly 305 m elevation, rising approximately 185 meters above the Piedmont hills. This park is known for its rhyolite quarries that were mined by Native Americans for centuries. Morrow Mountain Rhyolite (technically a metarhyodacite) is a hard, uniform and fine–grained rock that was favored for making stone tools such as arrowheads and spear points (Stewart and Roberson 2007).

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On 13 May 2006 I surveyed the lichens of Morrow Mountain State Park with park staff at their invitation. Specimens were collected from the following four sites:

(I) The forest immediately outside the park office (35°22'28"N, 80°04'26"W), elevation 130 m. Trees sampled included *Acer rubrum, Carya ovata, Quercus* sp. and *Ilex decidua.*

(II) Quarry Trail area and adjacent picnic area (35°22'43"N, 80°04'17"W), elevation 105 m. Habitat includes Mesic Mixed Hardwood Forest (Shafale and Weakley 1990) and argillite rock surfaces of an abandoned quarry and rock outcrops. The quarry was abandoned in the 1930's, with stone surfaces having a maximum age of lichen colonization of ~70 years. Phorophytes sampled include: *Fagus grandifolia, Ilex opaca* and fallen material of various species.

(III) Morrow Mountain Summit (35°21'11"N, 80°05'35"W), elevation 270 m. Habitat is Piedmont Monadnock Forest with a canopy dominated by chestnut oak (*Quercus prinus*) with other oaks (*Quercus* spp.) and hickories (*Carya* spp.) (Schafale and Weakley 1990).

(IV) Needle Eye – a basalt boulder field west of the road to the summit of Morrow Mountain, north of the bridle trail crossing (35°21'30"N, 80°05'28"W), elevation 165 m. Habitat is Piedmont Monadnock Forest with *Carya ovata* being the most sampled phorophyte.

Barnes Creek Bluffs

Barnes Creek Bluffs are in the Uwharrie National Forest, about 13 km NW of Troy in northern Montgomery County (35°28'48"N, 79°57'05"W). This 40.5 ha site is listed as a state–significant natural area (NC Natural Heritage Program 2008). According to a site profile prepared by the North Carolina Natural Heritage Program (NCNHP) (Schafale 1995), "The site is a complex of steep slopes and floodplains where Barnes Creek cuts through Dark Mountain. It supports several distinctive natural communities. The floodplain communities have a mixture of mountain and Coastal Plain species, with both mountain laurel [*Kalmia latifolia*] and titi [*Cyrilla racemiflora*]. A fairly extensive sloping rock outcrop is present…and supports a glade–like community with some species characteristic of high pH rocks…The site also contains a small boulderfield–like mesic forest with an extensive woody vine layer. The first of these communities is unlike anything known elsewhere in the state. The other two are very rare, undescribed natural community variants or new types."

This site's northernmost bluff was visited during an informal botanical field trip led by staff of the North Carolina Botanical Garden (NCBG) and NCNHP on 19 April 2008. We explored the floodplain north of Barnes Creek, and up the steep S–facing slope to near the summit, spanning an elevation range of 142–180 m. The slope was studded with boulders below outcrops of metamorphic and intermediate volcanic rocks. This bluff consisted of the three unique natural communities described above, here termed "Piedmont Alluvial Forest" along a floodplain adjacent to Barnes Creek, "Piedmont Mafic Glade" up the slope and "Dry Oak–Hickory Forest" near the summit.

Black Ankle Bog

The Nature Conservancy's Black Ankle Bog Preserve is located in the northeastern corner of Montgomery County, about 6 km SW from the town of Seagrove in neighboring Randolph County (35°29'58"N, 79°49'09"W). At 219 m elevation this preserve is 115 hectares and is listed as a nationally significant area (NC Natural Heritage Program 2008). The natural community is Hillside Seepage Bog (Schafale and Weakley 1990), a globally rare habitat that is ranked G1 (*i.e.*, known from five or fewer occurrences worldwide) with only two other occurrences in North Carolina. Also in the preserve is the equally rare Piedmont Longleaf Pine Forest, which is found only in Montgomery County. Although not a monadnock, this site has a geology that is of the same type (metamudstone and meta–argillite) as in the other sites yet distinct from that of the surrounding Piedmont (felsic metavolcanic) (Brown *et al.* 1985). Therefore, Black Ankle Bog has been determined to be a part of the Uwharrie Mountains region (M. Schafale, pers. comm.) and its lichens are reported here.

Black Ankle Bog was surveyed on 19 April 2008, following our visit to Barnes Creek Bluffs. We explored the bog and surrounding habitats, noting evidence of a prescribed burn that occurred about two years earlier.

Methods

In each area all lichen taxa encountered were collected. With each collection the forest layer (*i.e.*, floor, understory and canopy) and the substrate were recorded. The floor layer included soil, rocks, decaying logs and stumps, and tree bases up to 0.5 m height. The understory layer included vegetation (both trunks

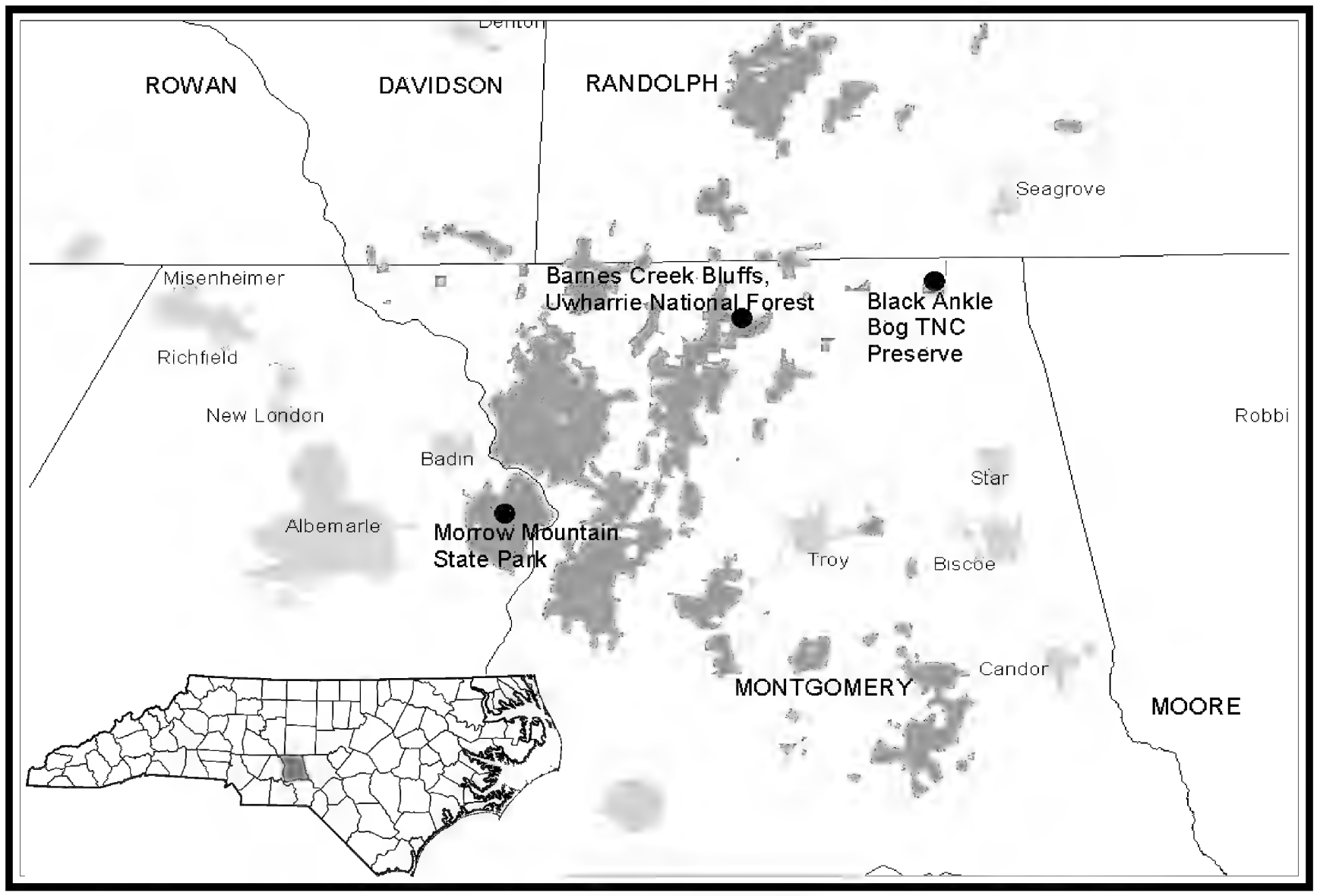

Figure 1. Map showing survey sites within the Uwharrie Mountains, North Carolina. Darker shaded areas are protected lands; lighter shaded areas depict towns.

and branches) from 0.5–2.0 m, as far as can be reached by hand. The canopy was represented by litterfall (fallen branches, tree limbs and bark fragments). This latter category also included downed trees from recent storms. Vouchers of each species encountered were collected and deposited in the UNC Herbarium (NCU) with select duplicates sent to the cryptogamic herbarium of the New York Botanical Garden (NY) for verification.

Specimens were determined using standard laboratory techniques, including microscopic examination of reproductive structures, chemical spot testing, and TLC (the latter at NY, using Solvents C and G following methods as applied by Lendemer and Tripp (2008)). Keys used include those in Brodo *et al.* (2001), Harris (1995) and Harris and Ladd (2005). Taxa were cross–referenced against checklists of Perlmutter (2008a) to determine new state records, and those of Perlmutter (2006, 2008) and Perlmutter & Lendemer (2008) to determine new North Carolina Piedmont records. Lichens encountered in the state park were also digitally imaged, some in the field and others later in the herbarium.

Lichen observation records and images from the Morrow Mountain visit were entered into North Carolina Division of Park and Recreation's Natural Resource Inventory Database (NRID). The NRID is a web–accessible database (http://207.4.179.38/Checklist/find.php) designed to bring public awareness to the park system's biodiversity. Species checklists of a given organismal grouping (e.g. "LICHEN") or that of a community (e.g. "TERRESTRIAL COMMUNITY") can be generated for a particular park or natural area (e.g. "Morrow Mountain State Park") from the pull–down menus, and printed for field use. The site also has an image gallery for further reference of a park's natural resources. Similarly, checklists were submitted to NCNHP as a condition of permission to collect at Barnes Creek Bluffs and Black Ankle Bog.

Taxa were analyzed by habit, forest layer (*i.e.*, floor, understory, canopy) and substrate to further characterize the lichen flora of this area.

Results And Discussion

The two forays yielded 137 collections representing 78 species in 47 genera. Of the 28 families represented by this flora, the largest are Parmeliaceae (15 spp.), Physciaceae (11 spp.), Lecanoraceae (8

spp.) and Pertusariaceae (6 spp.). Broken down by habit, the flora comprised 64% crustose, 27% foliose and 9% fruticose lichens, the latter including squamulose and dimorphic growth forms. Forty–four species were found in Morrow Mountain State Park, 53 in Barnes Creek Bluffs and 19 in Black Ankle Bog.

Lichens were found across all forest layers, with 41% of taxa found on the floor, 22% in the understory, and 37% in the canopy. On the floor most were found on rock (32% total flora taxa) with five species on soil and two on wood of downed, decaying logs. Corticolous species (representing both understory and canopy forest layers) make up 59% of taxa collected.

Compared to two other Piedmont lichen floras surveyed in North Carolina –Mason Farm Biological Reserve in Orange County and William B. Umstead State Park in Wake County, which yielded checklists of 100 and 150 taxa, respectively (Perlmutter 2008, Perlmutter and Lendemer 2008)–, the lichen flora of the Uwharrie Mountains appears to be somewhat less species rich at 78 taxa despite the high diversity of habitats sampled. This can be best explained by the limited time spent exploring in the Uwharries as compared to that given in the more intensive surveys conducted in the forests of Orange and Wake counties, despite the wide variation in sampling area (Mason Farm has 150 ha, Umstead State Park has 5500 ha, and combined area of this survey is approximately 2075 ha).

Nevertheless, the checklist in this report does give an indication of the lichen biodiversity of these monadnocks. For instance, many common taxa from the previous two surveys were found here, and are likely common throughout the Piedmont: *Arthonia quintaria, Bacidia schweinitzii, Buellia curtisii, Candelaria reflexa, Flavoparmelia caperata, Graphis scripta, Lecanora strobilina, L. subpallens, Loxospora pustulata, Myelochroa aurulenta, Nadvornikia sorediata, Ochrolechia africana, Parmotrema hypotropum, P. submarginale, Pertusaria epixantha, Physcia pumilior, Punctelia rudecta, Pyrrhospora varians, Trypethelium virens* and *Usnea strigosa*. Of the new Piedmont records, these were either overlooked/misidentified taxa (*Chrysothrix insulizans* and *Ionaspis alba*) or predominantly mountainous taxa (*e.g. Xanthoparmelia monticola*). The observation of *Fissurina insidiosa* in the Alluvial Forest at Barnes Creek Bluffs indicates that the lichen component of the vegetation is also Coastal Plain–affiliated. Further survey work is needed to better describe the lichen diversity of this fascinating region.

Annotated Checklist

Preliminary lichen checklist from forays to the Uwharrie Mountains, North Carolina, in 2006 and 2008. Nomenclature follows Esslinger (2008) unless otherwise indicated; family placement follows Lumbsch and Huhndorf (2007). Collection number(s) of voucher(s) follows each taxon, followed by site code in brackets (BA = Black Ankle Bog, BC = Barnes Creek Bluffs, MM = Morrow Mountain State Park). A notation on substrate and habitat (*i.e.*, natural community) is provided for each taxon, as well as a brief description if seemingly undescribed. [1]New record for North Carolina; [2]new record for the North Carolina Piedmont.

Arthonia quintaria Nyl. (Arthoniaceae) – *405*, *426, 1438* [BA, MM]. On twigs and branches, including *Acer rubrum* and *Liquidambar styraciflua* in Mesic Mixed Hardwood Forest and Hillside Seepage Bog.

Arthonia sp. (Arthoniaceae) – *436* [MM]. Resembles *A. dryadum* R.C. Harris & Ladd ined. in photobiont and spore characteristics, but differs in chemistry (epihymenium K+ red–violet, pigments dissolving; C–, KC–). On *Ilex opaca* sapling in Mesic Mixed Hardwood Forest.

Arthothelium taediosum auct. Amer. (Arthoniaceae) – *1395, 1434, 1444* [BA, BC]. On branches, including *Liquidambar styraciflua*, and on *Acer rubrum* snag in Dry Oak–Hickory Forest and Hillside Seepage Bog.

Aspicilia sp. (Megasporaceae) – *1407a* [BC]. Thallus dark gray, rimose; spores simple, hyaline, 18–20 × 12–14 µm; stictic acid. On circumneutral metamorphic rock in Piedmont Mafic Glade.

Bacidia circumspecta (Nyl. ex Vain.) Malme (Ramalinaceae) – *419* [MM]. On *Carya ovata* trunk in Mesic Mixed Hardwood Forest.

Bacidia polychroa (Th. Fr.) Körb. (Ramalinaceae) – *418* [MM]. On *Carya ovata* trunk in Mesic Mixed Hardwood Forest.

Bacidia schweinitzii (Fr. ex E. Michener) A. Schneid. (Ramalinaceae) – *409, 420* [MM]. On maple trunks in Mesic Mixed Hardwood Forest.

Bathelium carolinianum (Tuck.) R.C. Harris (Trypetheliaceae) – *1385* [BC]. On *Acer rubrum* trunk in Piedmont Mafic Glade.

Buellia curtisii (Tuck.) Imshaug (Syn. *Baculifera curtisii* in Esslinger 2008) (Physciaceae) – *416*, *444* [MM]. On hardwood branches in Mesic Mixed Hardwood Forest and Piedmont Monadnock Forest.

Buellia maculata Bungartz (Physciaceae) – *458, 1404, 1419* [BC, MM]. On basaltic and circumneutral metamorphic rock in Piedmont Moanadnock Forest and Piedmont Mafic Glade, respectively.

Buellia stillingiana J. Steiner (Physciaceae) – *424, 432* [MM]. On fallen bark fragments in Mesic Mixed Hardwood Forest and Piedmont Monadnock Forest.

[2]*Caloplaca sideritis* (Tuck.) Zahlbr. (Teloschistaceae) – *1411* [BC]. On circumneutral metamorphic rock in Piedmont Mafic Glade. Previously reported from Graham County in the mountain physiographic province of western North Carolina (Wetmore 1996).

Candelariella reflexa (Nyl.) Lettau (Candelariaceae) – *447* [MM]. On a hardwood branch in Piedmont Monadnock Forest.

Canoparmelia caroliniana (Nyl.) Elix & Hale (Parmeliaceae) – *1432, 1437* [BA]. On hardwood trees including *Liquidambar styracilua* in Hillside Seepage Bog.

Canoparmelia texana (Tuck.) Elix & Hale (Parmeliaceae) – *453* [MM]. On *Quercus rubra* in Piedmont Modnadnock Forest.

[2]*Chrysothrix insulizans* R.C. Harris & Ladd (Chrysotrichaceae) – *369, 1400, 1416* [BC, MM]. On argillite quarry wall in Mesic Mixed Hardwood Forest, and circumneutral metamorphic outcrops in Dry Oak–Hickory Forest and Piedmont Mafic Glade. Two specimens from the North Carolina Piedmont (*W.L. Culberson 10842*, Orange County [DUKE] and *P.O. Schallert s.n.*, Stokes County [NCU]) were reported as *C. candelaris* in Perlmutter (2006). These plus *W.L. Culberson 10422* (Chatham Co. [DUKE]) had since been redetermined as *C. insulizans*; the DUKE material by B.P. Hodkinson.

Chrysothrix xanthina (Vain.) Kalb (Chrysotrichaceae) – *425, 1398* [BC, MM]. On pine and oak trunks in Mesic Mixed Hardwood Forest and Dry Oak–Hickory Forest, repsectively. Additional specimens from the North Carolina Piedmont include *W.L. Culberson 6391* (Person County) and *W.L. Culberson 12123* (Orange County), both determined by B.P. Hodkinson (DUKE).

Cladonia apodocarpa Robbins (Cladoniaceae) – *1388, 1391* [BC]. On soil in Dry Oak–Hickory Forest and Piedmont Mafic Glade.

Cladonia ochrochlora Flörke (Cladoniaceae) – *437* [MM]. On wood of decaying log in Mesic Mixed Hardwood Forest.

Cladonia pleurota (Flörke) Schaerer (Cladoniaceae) – *1421BA* [BA]. On soil in Hillside Seepage Bog.

Cladonia subtenuis (Abbayes) Mattick (Cladoniaceae) – observed [BC]. On soil / duff in Piedmont Mafic Glade. Specimens collected were subsequently lost; they were determined in the field based on author's experience with this common Piedmont cladonia (Perlmutter 2006, 2008, Perlmutter & Lendemer 2008).

Dibaeis baeomyces (L. f.) Rambold & Hertel (Icmadophilaceae) – *1428* [BA]. On soil of tip–up mound in Hillside Seepage Bog.

[2]*Dirinaria frostii* (Tuck.) Hale & W.L. Culb. (Physciaceae) – *1409* [BC]. On metamorphic rock in Piedmont Mafic Glade. Previously reported from the mountains of Buncombe County (Perry & Moore 1969).

[2]*Fissurina insidiosa* C. Knight & Mitten (Graphidaceae) – observed [BC]. On *Cyrilla racemiflora* trunk in Piedmont Alluvial Forest. Specimens collected were subsequently lost; they were determined in the field based on author's experience with this distinctive graphid (Perlmutter 2007). *Fissurina. insidiosa* is noteworthy as it is a Coastal Plain species not yet reported from the Piedmont. Similarly, it was found further inland in Gorges State Park of North Carolinas mountain province, which surprisingly also has Coastal Plain affinities in its lichen biota (Lendemer and Tripp 2008).

Flavoparmelia baltimorensis (Gyeln. & Fóriss) Hale (Parmeliaceae) – *439, 1403* [BC, MM]. On argillite quarry wall in Mesic Mixed Hardwood Forest and on metamorphic rock in Piedmont Mafic Glade.

Flavoparmelia caperata (L.) Hale (Parmeliaceae) – *422, 1422BA* [BA, MM]. On hardwoods in Mesic Mixed Hardwood Forest and Hillside Seepage Bog.

Graphis scripta (L.) Ach. (Graphidaceae) – *434, 1382* [BC, MM]. On *Ilex opaca* trunks in Mesic Mixed Hardwood Forest and Piedmont Mafic Glade.

[2]*Ionaspis alba* Lutzoni (Hymeneliaceae) – *1410* [BC]. On metamorphic rock in Piedmont Mafic Glade. This saxicolous crust has been reported from the Piedmont of Georgia (Beeching *et al.* 2008).

Lecanora hybocarpa (Tuck.) Brodo (Lecanoraceae) – *430, 1373* [BC, MM]. On hardwood branches in Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest.

Lecanora oreinoides (Körb.) Hertel & Rambold (Lecanoraceae) – *461, 1389* [BC, MM]. On basalt and metamorphic rock in Piedmont Monadnock Forest and Piedmont Mafic Glade, respectively.

Lecanora strobilina (Spreng.) Kieff. (Lecanoraceae) – *402*, *445, 1392, 1440* [BA, BC, MM]. On hardwood branches and twigs in Mesic Mixed Hardwood Forest, Piedmont Monadnock Forest and Dry Oak–Hickory Forest.

Lecanora subimmergens Vain. (Lecanoraceae) – *1405, 1418* [BC]. On circumneutral metamorphic rock in Piedmont Mafic Glade.

Lecanora subpallens Zahlbr. (Lecanoraceae) – *414, 1394* [BC, MM]. On hardwood branches in Mesic Mixed Hardwood Forest and Dry Oak–Hickory Forest.

Lecidella enteroleucella (Nyl.) Hertel (Lecanoraceae) – *454, 1399* [BC, MM]. On basalt and metamorphic rock in Piedmont Monadnock Forest and Piedmont Mafic Glade, respectively.

Lepraria lobificans Nyl. (Stereocaulaceae) – *1415* [BC]. On circumneutral metamorphic cobble in Piedmont Mafic Glade.

Loxospora pustulata (Brodo & W.L. Culb.) R.C. Harris (Sarrameanaceae) – *459, 1396* [BC, MM]. On *Carya ovata* and *Quercus rubra* trunks in Piedmont Monadnock Forest and Dry Oak–Hickory Forest, respectively.

Melanelixia subargentifera (Nyl.) O. Blanco *et al.* (Parmeliaceae) – *438* [MM]. On shaded, vertical argillite rock face of abandoned quarry in Mesic Mixed Hardwood Forest. Specimen was sent to HBG for molecular analysis.

Multiclavula cf. *corynoides* (Peck) R.H. Petersen (lichenized Basidiomycota) – *1429* [BA]. On soil of tip–up mound in Hillside Seepage Bog.

[1]*Mycoporum acervatum* R.C. Harris (Mycoporaceae) – *1442* [BA]. On exposed oak sapling stem in Hillside Seepage Bog. This crust has also been collected from planted *Quercus phellos* trees in Raleigh, NC (*G.B. Perlmutter 1164, 1604* [NCU]).

Mycoporum compositum (A. Massal.) R.C. Harris (Mycoporaceae) – *1443* [BA]. On exposed oak sapling stem in Hillside Seepage Bog.

Myelochroa aurulenta (Tuck.) Elix & Hale (Parmeliaceae) – *1417* [BC]. On metamorphic rock in Piedmont Mafic Glade.

Myelochroa obsessa (Ach.) Elix & Hale (Parmeliaceae) – *1414a* [BC]. On metamorphic rock in Dry Oak–Hickory Forest.

Nadvornikia sorediata R.C. Harris (Thelotremataceae) – *421*, *460* [MM]. On hardwood trunks in Mesic Mixed Forest and Piedmont Monadnock Forest.

Ochrolechia africana Vain. (Ochrolechiaceae) – *1393, 1435* [BA, BC]. On hardwood branches in Dry Oak–Hickory Forest and Hillside Seepage Bog.

Parmotrema hypoleucinum (Steiner) Hale (Parmeliaceae) – *455* [MM]. On wood of a hickory log in Piedmont Monadnock Forest.

Parmotrema hypotropum (Nyl.) Hale (Parmeliaceae) – *396, 431*, *1371, 1425* [BA, BC, MM]. On branches and twigs in Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, Piedmont Monadnock Forest and Hillside Seepage Bog.

Parmotrema perforatum (Jacq.) A. Massal. (Parmeliaceae) – *406, 413*, *442*, *452* [MM]. On hardwood branches in Mesic Mixed Hardwood Forest and Piedmont Monadnock Forest.

Parmotrema reticulatum (Taylor) Hale (Parmeliaceae) – *1424, 1427, 1433* [BA]. On bark in Hillside Seepage Bog.

Parmotrema subisidiosum (Müll. Arg.) Hale & A. Fletcher (Parmeliaceae) – *440, 1387, 1390, 1436, 1443a* [BA, MM]. On bark of hardwoods and conifers as well as rock in Mesic Mixed Hardwood Forest, Mafic Glade, Dry Oak–Hickory Forest and Hillside Seepage Bog.

Parmotrema submarginale (Michx.) DePriest & B.W. Hale (Parmeliaceae) – *400*, *427*, *451, 1379, 1441* [BA, BC, MM]. On bark of hardwoods and conifers in Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, Piedmont Monadnock Forest and Hillside Seepage Bog.

Pertusaria epixantha R.C. Harris (Pertusariaceae) – *408, 1376, 1397, 1426* [BA, BC, MM]. On hardwood trunks and branches in Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, Dry Oak–Hickory Forest and Hillside Seepage Bog.

Pertusaria ostiolata Dibben (Pertusariaceae) – *449* [MM]. On *Cornus florida* trunk in Piedmont Monadnock Forest.

Pertusaria paratuberculifera Dibben (Pertusariaceae) – *407*, *457* [MM]. On *Acer rubrum* and *Carya ovata* trunks in Mesic Mixed Hardwood Forest and Piedmont Monadnock Forest.

Pertusaria subpertusa Brodo (Pertusariaceae) – *1378* [BC]. On hardwood branch in Piedmont Alluvial Forest.

Pertusaria texana Müll. Arg. (Pertusariaceae) – *448* [MM]. Corticolous in Piedmont Monadnock Forest.

Pertusaria velata (Turner) Nyl. (Pertusariaceae) – *441* [MM]. On hardwood branch in Mesic Mixed Hardwood Forest.

Pertusaria xanthodes Müll. Arg. (Pertusariaceae) – *401*, *446* [MM]. On hardwood branches in Mesic Mixed Hardwood Forest and Piedmont Monadnock Forest.

Phaeographis inusta (Ach.) Müll. Arg. (Graphidaceae) – *428* [MM]. On hardwood branch in Piedmont Monadnock Forest.

Phaeophyscia adiastola (Essl.) Essl. (Physciaceae) – *1413* [BC]. On metamorphic rock in Piedmont Mafic Glade.

Phlyctis ludoviciensis (Müll. Arg.) Lendemer (Phlyctidaceae) – *1377* [BC]. On fallen hardwood branch in Piedmont Alluvial Forest.

Physcia atrostriata Moberg *et al.* (Physciaceae) – *1386* [BC]. On *Juniperus virginiana* trunk in Piedmont Mafic Glade.

Physcia pumilior R.C. Harris (Physciaceae) – *404, 1380, 1439* [BA, BC, MM]. On fallen branches and twigs in Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest and Hillside Seepage Bog.

Physcia stellaris (L.) Nyl. (Physciaceae) – *1375* [BC]. On fallen branch in Piedmont Alluvial Forest.

Physcia subtilis Degel. (Physciaceae) – *1407b*, *1420* [BC]. On metamorphic outcrop in Piedmont Mafic Glade and Dry Oak–Hickory Forest.

Polymeridium proponens (Nyl.) R.C. Harris (Trypetheliaceae) – *1372* [BC]. On *Liquidambar styraciflua* sapling in Piedmont Mafic Glade.

Polysporina simplex Davies Vězda (Acarosporaceae) – *1431* [BA]. On metasandstone outcrop in Hillside Seepage Bog.

Porpidia albocaerulescens (Wulfen) Hertel & Knoph (Lecideaceae) – *1406* [BC]. On circumneutral metamorphic cobble in Piedmont Mafic Glade.

Pseudosagedia guentheri (Flot.) Hafellner & Kalb (Porinaceae) – *1401* [BC]. On metaconglomerate rock in Piedmont Mafic Glade.

Punctelia rudecta (Ach.) Krog (Parmeliaceae) – *415*, *423*, *450, 1384, 1423BA* [BA, BC, MM]. On hardwood and conifer bark in Mesic Mixed Hardwood Forest, Piedmont Monadnock Forest, Piedmont Mafic Glade and Hillside Seepage Bog.

Pyrrhospora varians (Ach.) R.C. Harris (Lecanoraceae) – *429, 433, 1374* [BC, MM]. On fallen bark in Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest.

Pyxine subcinerea Stirt. (Physciaceae) – *456* [MM]. On *Carya ovata* trunk in Piedmont Monadnock Forest.

[1]*Rinodina destituta* (Nyl.) Zahlbr. (Physciaceae) – *1412, 1422* [BC]. On metamorphic rock in Piedmont Mafic Glade. A search of the literature failed to reveal any reports of this taxon in North Carolina; however, web–accessible herbarium records from NY (http://sciweb.nybg.org/science2/hcol/lena/index.asp, accessed 22 December 2008) indicate that it is widespread in eastern North America.

Trapelia glebulosa (Sm.) J. R. Laundon (Agyriaceae) – *1402* [BC]. On a pebble in an upturned root bole in Piedmont Mafic Glade.

Trypethelium virens Tuck. *ex* Michener (Trypetheliaceae) – *435, 1383* [BC, MM]. On *Ilex opaca* trunks in Mesic Mixed Hardwood Forest, Piedmont Monadnock Forest and Piedmont Mafic Glade. Common on smooth bark of hollies (*Ilex* spp.) almost exclusively in shaded forests.

Usnea strigosa (Ach.) Eaton (Parmeliaceae) – *399* [MM]. On fallen *Quercus rubra* bark fragment in Piedmont Monadnock Forest.

Verrucaria sp. (Verrucariaceae) – *1408* [BC]. Thallus dark, endolithic; perithecia minute; spores simple, hyaline, 8 per ascus, 28–34 × 8–10 µm. On metamorphic (metavolcanic?) rock in Piedmont Mafic Glade.

[2]*Xanthoparmelia monticola* (J.P. Dey) Hale (Parmeliaceae) – *1414*, *1423* [BC]. On metamorphic rock in Piedmont Mafic Glade and Dry Oak–Hickory Forest. This rock shield lichen is tracked by NCNHP as SR–L, meaning it is rare with a species range limited to North Carolina and adjacent states, and a global ranking of G2, meaning it is imperiled with 6–20 populations (Franklin and Finnegan 2006). Five records of this species are currently known in the state, all from high elevation rock outcrops in the southern Appalachians. This represents the first record outside its known range in the southern Appalachians. Other monadnock outcrops should be surveyed for this lichen.

Indetermined – *443* [MM]. Resembles *Phyllopsora*: thallus microsquamulose, gray–green; apothecia biatorine, black. Specimen under further study by J.C. Lendemer (NY). On wood of decaying log in Mixed Mesic Hardwood Forest.

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Literature Cited

Beeching, S.Q., G.B. Perlmutter and C.J. Hansen. 2008. Lichen Checklist from the Liking Lichens Teacher Workshops at Charlie Elliott Wildlife Center, Georgia, USA. Evansia, 25(2): 34–39.

Brodo, I.M., S.D. Sharnoff and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven, CT. 795pp.

Brown, P.M., E.R. Burt, III, P.A. Carpenter, III, R.M. Enos, B.J. Flynt, Jr., P.E. Gallagher, C.W. Hoffman, C.E. Merschat, W.F. Wilson and J.M. Parker, III. 1985. Geologic Map of North Carolina. The North Carolina Geological Survey, Raleigh, NC.

Daniel, I.R. Jr. and J.R. Butler. 1996. An archaeological survey and petrographic description of rhyolite sources in the Uwharrie Mountains, North Carolina. Southern Indian Studies, 45: 1–37.

Esslinger, T.L. 2008. A cumulative checklist for the lichen–forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.html (First Posted 1 December 1997, Most Recent Version (#14) 8 October 2008), Fargo, North Dakota.

Franklin, M.A. and J.T. Finnegan. 2006. Natural Heritage Program list of rare plant species of North Carolina 2006. North Carolina Natural Heritage Program, Office of Conservation and Community Affairs, N.C. Department of Environment and Natural Resources, 1601 MSC, Raleigh, NC 27699–1601. 136 pp.

Harris, R.C. 1995. More Florida Lichens, including a 10¢ tour of the pyrenolichens. Published by the author, Bronx, NY. 192 pp.

Harris, R.C. and D. Ladd. 2005. Preliminary Draft: Ozark Lichens. Enumerating the Lichens of the Ozark Highlands of Arkansas, Illinois, Kansas, Missouri, and Oklahoma. Prepared for the 14th Tuckerman Lichen Workshop, Eureka Springs, AK. 249 pp.

Lendemer, J.C. and E.A. Tripp. 2008. Contributions to the lichen flora of North Carolina: a preliminary checklist of the lichens of Gorges State Park. The Bryologist, 111(1): 57–67.

Lumbsch, H.T. and S.M. Huhndorf (eds.). 2007. Outline of Ascomycota – 2007. Myconet, 13: 1–58.

NC Natural Heritage Program. 2008. 2008 North Carolina Heritage Program Biennial Biennial Protection Plan: list of significant natural heritage areas. NC Department of Environment and Natural Resources, Raleigh, NC (http://www.ncnhp.org/Pages/publications.html, accessed 28 October 2008).

Perlmutter, G.B. 2006. Lichen inventory of the North Carolina Piedmont. Castanea, 71(4): 282–294.

Perlmutter, G.B. 2007. A supplemental checklist of lichens in Theodore Roosevelt State Natural Area, North Carolina, with a note on the rare *Teloschistes flavicans*. Evansia, 24(4): 116–121.

Perlmutter, G.B. 2008. The lichen biota of Mason Farm Biological Reserve, North Carolina. J. North Carolina Acad. Sci., 124(3): 82–90.

Perlmutter, G.B. 2008a. Checklist of lichens and lichenicolous fungi of North Carolina (USA). Version 1 June 2008. – http://www.checklists.de.

Perlmutter, G.B. and J.C. Lendemer. 2008. Contributions to the lichen flora of North Carolina: a preliminary checklist of the lichens at William B. Umstead State Park. Opuscula Philolichenum, 5: 67–76.

Perry, J.D. and B.J. Moore. 1969. Preliminary check list of foliose and fruticose lichens in Buncombe County, North Carolina. Castanea, 34: 146 – 157.

Schafale, M.P. 1995. Barnes Creek Bluffs. [North Carolina Natural Heritage Program site survey report, Natural Heritage Program files, NC Department of Environment and Natural Resources, Raleigh, NC.]

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program, Raleigh, NC. 321 pp.

Stewart, K.G. and M.R. Roberson. 2007. Exploring the Geology of the Carolinas. University of North Carolina Press, Chapel Hill, NC. 298 pp.

Wetmore, C.M. 1996. The *Caloplaca sideritis* group in North and Central America with brown or black apothecia. The Bryologist, 99(3): 292–314.

Opuscula Philolichenum, **6**: 73–80. 2009.

Two New Usnic Acid Containing Species of *Lecanora* from Western North America

James C. Lendemer[1] & Kerry Knudsen[2]

ABSTRACT. – Two new species of *Lecanora* are described from western North America. *Lecanora austrocalifornica*, a species outwardly similar to *L. conizaeoides*, occurs in the Peninsular Ranges of southern California. And *L. simeonensis,* a sorediate species with usnic acid and zeorin, is found at scattered localities along the Central Coast.

Introduction

The genus *Lecanora* is remarkably diverse in the Greater Sonoran Desert Region, with more than one hundred taxa already reported (Ryan et al. 2004) many of which are not known to occur elsewhere. Members of the *L. varia* group, which contain usnic acid and/or the biologically related compound isousnic acid (Printzen 2001), are particularly common in southern California where we have conducted extensive field work in recent years. Despite having several substantial modern revisions of the *L. varia* group in North America (Printzen 2001, Ryan et al. 2004, Śliwa & Wetmore 2000) we have repeatedly collected material of additional apparently unknown species. Two of these are described here.

Materials and Methods

Thalli and apothecia were measured dry with a Bausch & Lomb StereoZoom 7 dissecting microscope. Microscopic characters were measured in water with an Olympus BX51 microscope and images captured with a Nikon CoolPix990 digital camera. Photographs were taken with the same dissecting microscope, camera, and prepared in Adobe Photoshop. Sections of the apothecia were prepared by hand cutting with a razor blade and mounted in water. Measurements of anatomical characters, ascospores, and conidia are based on water mounts prior to the application of 10% KOH (K), or I. Potential differences between the mean size of ascospores in *L. austrocalifornica* and *L. conizaeoides* Nyl. ex Cromb. were tested using the MANOVA model platform of JMP v. 5.2.1 and found to be highly statistically significant ($P<0.0001$). Specimens were studied with thin layer chromatography (TLC) using solvents C and G following the standardized methods of Culberson & Kristinsson (1970).

The New Species

1. *Lecanora austrocalifornica* Lendemer & K. Knudsen sp. nov.
Mycobank #512988.

Plate 1 (page 77).

Habitus similis *L. conizaeoidis*, praecipue differt sporis minoribus et conidiis longioribus. Sorediis destitutus.

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Character	L. austrocalifornica	L. conizaeoides	L. densa	L. laxa	L. varia
Soredia present	no	yes or no	no	no	no
Apothecial margin	uniform	uniform	uniform	uniform	differentiated
Ascospore length	(8.1)-**8.7**-(9.2)	(9.25)-**10.1**-(10.95)	(6.5)-**8.0-9.5**-(11.0)	(6.5)-**7.8-9.6**-(12.0)	**10.2-12.5**
Ascospore width	(4.5)-**5.0**-(5.3)	(5.9)-**6.5**-(7.1)	(5.0)-**5.4-6.4**-(7.5)	(3.5)-**4.1-6.1**-(7.5)	**5.0-5.5**
Conidia	filiform	filiform	unknown	unknown	filiform
Conidia length	18-25	12-22	unknown	unknown	12-22
Secondary chemistry:					
Fumarprotocetraric acid	**present**	**present**	absent	absent	absent
Psoromic acid	absent	absent	**present**	absent	**present**
P spot test	orange-red	orange-red	yellow	none	yellow

Table 1. Tabular comparison of *Lecanora austrocalifornica*, *L. conizaeoides, L. densa, L. laxa,* and *L. varia*. Data for *L. conizaeoides*, *L. densa, L. laxa,* and *L. varia* taken from Śliwa & Wetmore (2000) and Printzen (2001), and confirmed by observations of herbarium materials at NY. Conidia measurements for *L. conizaeoides* and *L. varia* taken from Purvis et al. (1992).

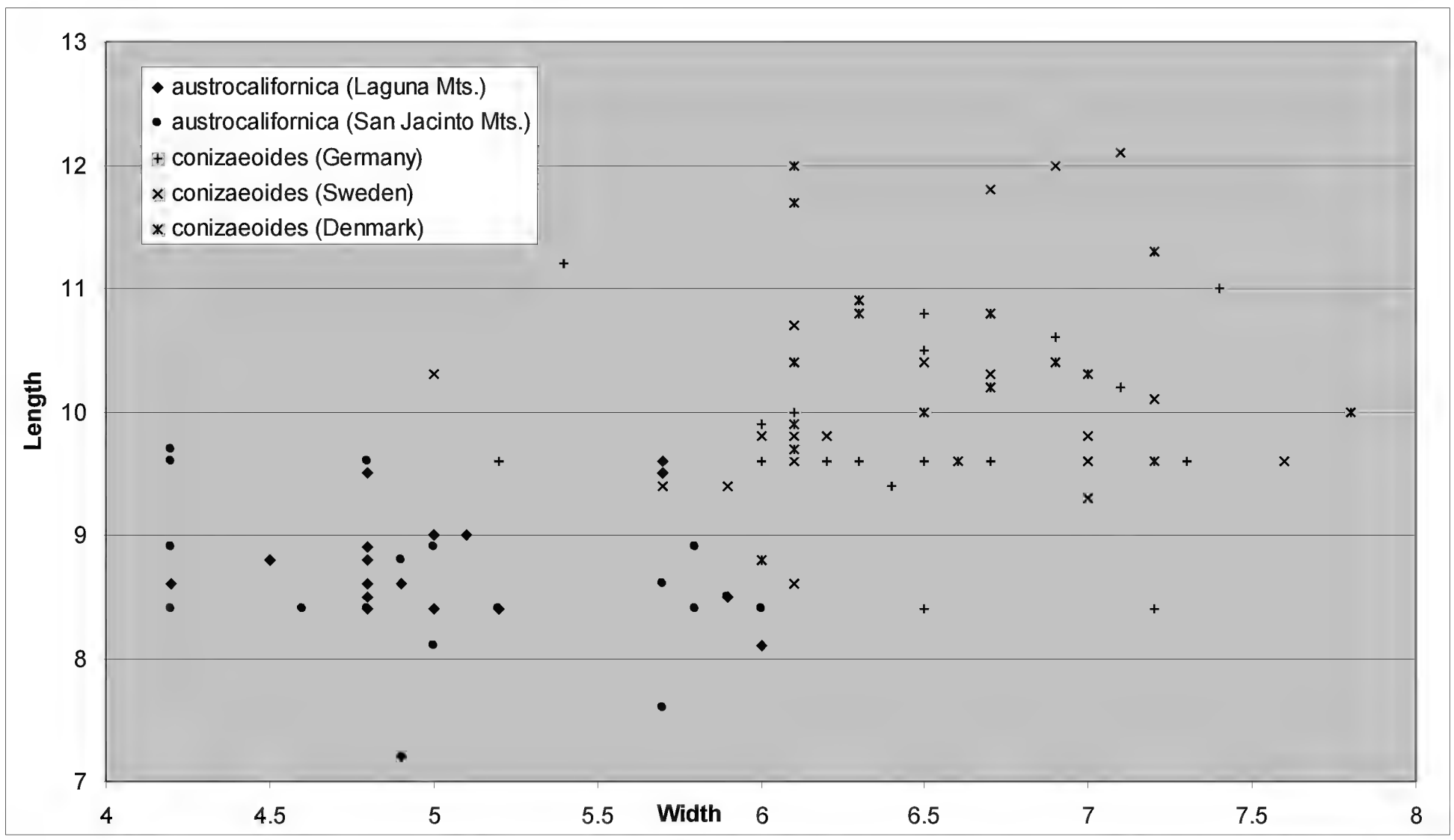

Table 2. Scatter plot comparison of ascospore length/width of *Lecanora austrocalifornica* and *L. conizaeoides*.

TYPE: **U.S.A. CALIFORNIA**. RIVERSIDE CO.: San Jacinto Mountains, San Bernardino National Forest, Apple Canyon, along Apple Canyon Road, 33°41'36"N, 116°39'28"W, 1463 m, Jeffrey Pines (*Pinus jeffreyi*) along stream, on *Pinus jeffreyi*, 31.i.2006, *J.C. Lendemer 15000 & K. Knudsen* = *Lichens of Eastern North America VII: 332* (NY holotype; UCR, isotype).

DESCRIPTION. – Thallus warted–areolate, endosubstratal and visible only around the apothecia or incipient apothecia, not sorediate or isidiate; areoles aggregated close to the apothecia, yellow to greenish–brown or tan, irregular, plane to convex, dull, epruinose, (0.15)–0.23–(0.3) mm in diameter. Hypothallus absent. Apothecia round, regular, initially plane, weakly (or rarely strongly) flexuous, often aggregated in crowded groups or occasionally singular, sessile, constricted at the base, (0.28)–0.46–(0.65) mm in diameter; disc weakly white pruinose, yellow–brown to greenish, often somewhat or entirely discolored blue–black (due to the presence of an anamophic lichenicolous fungus), flat to weakly convex (rarely stongly convex), expanding, dull; margin concolorous with thallus, prominent and persisting, distinct and often knobby, often thinning as the disc expands. Amphithecium corticate, (60)–86–(110) µm laterally, (85)–107–(128) µm below; cortex 10–15 µm wide above, 25–60 µm wide below, colorless with outer layer of granules (as in the epihymenium), composed of gelatinized anticlinally arranged hyphae with lumina 1.5–4 µm wide; medulla with irregularly entangled hyphae ca. 2 µm wide; parathecium present or absent, 10–20 µm wide; hypothecium colorless to hyaline sometimes yellowish, 39 µm tall; hymenium colorless to yellowish or tan, ca. 50 µm tall; epihymenium orange–brown, 12 µm high, inspersed with POL– granules dissolving in K; paraphyses simple to poorly branched (above and/or below) sometimes weakly anastomosing, without pigmentation, apical lumina (1)–2.5–(3) µm wide; asci 30–40 x 11–14 µm; ascospores 8 per ascus, colorless, simple, (8.1)–8.7–(9.2) x (4.5)–5.0–(5.3) µm. Pycnidia immersed in thallus, walls brown. Conidia colorless, simple, filiform, ca. 18–25 x 1 µm.

CHEMISTRY. – Usnic acid (cortex), fumarprotocetraric acid (medulla), and traces of protocetraric acid (medulla). Spot tests: K+ dirty yellowish–brown, C–, KC+ yellowish, P+ orange–red, UV–.

ETYMOLOGY. – The epithet "austrocalifornica" refers to occurrence of the new species in southern California, USA.

ECOLOGY. – *Lecanora austrocalifornica* occurs primarily on the bark of twigs and small branches of Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.), in the San Jacinto and Laguna Mountains of the peninsular ranges of southern California, where it is common at the altitude of approximately 1219–1828 meters, i.e., at the general elevational range of *P. jeffreyi* in southern California (Thorne 1977). It can easily be collected from small wind–sheared branches lying in piles at the base of Jeffrey pines, persisting as the branches dry and the bark splits and crumbles. We have also collected it on the coastal slope of the San Jacinto Mountains in the lower edge of the white fir forest on *Abies concolor* (Gordon & Glend.) Hildebr. in mixed corticolous communities between approximately 1981–2133 meters, but it was rare at this elevation as *L. laxa* (Śliwa & Wetmore) Printzen becomes dominant.

Brown and Brown (1968) marshaled evidence that *Lecanora conizaeoides* successfuly spread into polluted areas not only because it was pollution tolerant but it also thrived in habitats with low competition. Thus *L. conizaeoides* disappears when pollution is lowered and it has to compete with more diverse lichen communities. *Lecanora austrocalifornica* seems to also prefer low competition and is usually found growing alone. But there is no sign it is spreading from yellow pine forests to lower elevations on chaparral and coastal sage scrub in more polluted areas like the Hemet Valley below the San Jacinto Mountains or into Banning Pass where the pollution flows inland around the base of the San Jacinto Mountains toward Palm Springs. The earliest collection we have seen from the San Jacinto Mountains was made in the 1930's by Edmund Jaeger and is deposited in the Riverside Museum: it is a small branch of *Pinus jeffreyi* covered with *L. austrocalifornica.* This collection was made long before air pollution, especially ozone, was a problem in the San Jacinto Mountains.

DISTRIBUTION. – The species is currently known from the San Jacinto (Riverside County) and Laguna Mountains (San Diego County) in southern California, from the elevation of approximately 1219–1828 meters. While the actual distribution of *L. austrocalifornica* may be wider, potentially reflecting that of its primary phorophyte, we are unaware of any additional occurrences (see discussion below). *Pinus jeffreyi* occurs from the Sierra San Pedro Mártir in Baja California, Mexico, to the mountains of western Nevada, USA, and southern Oregon, USA (Griffin 1993).

Discussion. – Despite the nearly exhaustive study of usnic acid containing species of *Lecanora* in the Greater Sonoran Desert Region, *L. austrocalifornica* does not appear to have been encountered during the revisionary work by Printzen (2001) or Śliwa and Wetmore (2000) as those works do not mention any species from southern California with fumarprotocetraric acid. This is somewhat puzzling considering the frequency and abundance of *L. austrocalifornica* at some localities, and the fact that it was collected at least as early as 1930. Perhaps it has been previously misidentified as *L. varia* or *L. densa* because of the positive reaction with P. Indeed, it is outwardly almost identical to those species.

On the basis of apothecial anatomy and chemistry *Lecanora austrocalifornica* clearly belongs to "group three" of Printzen (2001). This group as defined by Printzen (2001) includes nine species, of which *L. densa, L. laxa,* and *L. varia* are most similar to *L. austrocalifornica* in ascospore size and apothecial anatomy. This group also includes *L. conizaeoides* a species not treated by Printzen (2001) because it is not known from the Greater Sonoran Desert Region (Ryan et al. 2004), but which was considered morphologically similar to *L. varia* by Śilwa and Wetmore (2000). A table summarizing the differences between *L. austrocalifornica* and the four taxa mentioned above is provided here (Table 1).

The presence of fumarprotocetraric acid in *Lecanora austrocalifornica* would immediately lead one to compare the species to *L. conizaeoides*. *Lecanora conizaeoides* is a European species that originally occupied old growth pine forests but subsequently spread throughout Europe during periods of increased sulphur dioxoide pollution (Laundon 2003). The species is not native to North America, and its sporadic occurrence and subsequent spread in coastal regions of the continent is presumed to be due to recent introductions (Ahti 1965, LaGreca & Stutzman 2003). While the ecological niche of *L. austrocalifornica* is comparable to that originally occupied by *L. conizaeoides* in Europe, the new species is easily separated from *L. conizaeoides* by its scant esorediate thallus, smaller ascospores, and longer conidia.

In fact, *Lecanora austrocalifornica* is more comparable to *L. densa* and *L. laxa*, and almost certainly is more closely related to them than to *L. conizaeoides*. Both *L. densa* and *L. laxa* are also morphologically similar to *L. conizaeoides* but differ in their thallus type and smaller ascospores (conidia are as yet unknown in *L. densa* and *L. laxa*) as well as their chemistry (see Table 1). Presently, *L. austrocalifornica* and *L. densa* are not known to be sympatric. However, should they be found together, the latter can be separated by the presence of psoromic acid (P+ yellow) rather than fumarprotocetraric acid (P+ orange–red) and by its wider ascospores. Interestingly, the ranges of *L. austrocalifornica* and *L. laxa* do overlap in the high elevations of the peninsular ranges (see discussion in ecology section), and *L. laxa* is most similar to *L. austrocalifornica* differing essentially only by the absence of fumarprotocetraric acid and a wider geographic distribution northward in California.

Selected specimen examined. – **U.S.A. CALIFORNIA**. RIVERSIDE CO.: San Bernardino National Forest, San Jacinto Mountains, above Pacific Crest Trail, 33°34'31"N, 116°34'17"W, 1491 m, 8.v.2005, *Lendemer 4207 & Knudsen* (NY, UCR); San Bernardino National Forest, San Jacinto Mountains, Idyllwild, near Inspiration Point, 33°43'61"N, 116°45'03"W, 1602 m, on bark of small branches of *Pinus jeffreyi*, 4.viii.2005, *K. Knudsen 3444* (UCR); San Bernardino National Forest, San Jacinto Mountains, San Jacinto Wilderness Area, Devil's Slide, 33°46'27"N, 116°40'23"W, 2472 m, on bark of *Abies concolor*, 15.ix.2006, *K. Knudsen 7186* (UCR). SAN DIEGO CO.: Cleveland National Forest, E of Los Gatos Ravine, W of Mount Laguna, on the N slope (S facing) of Escondito Ravine, 32°52'7"N, 116°25'49"W, ca. 1830 m, on *Libocedrus decurrens*, 14.vi.2004, *T.H. Nash 43991* (NY).

Reference specimens of *L. conizaeoides* examined. – **DENMARK**. E of Silkeborg, 3.iii.1968, on old pines, *S. Svane 20* (NY). **GERMANY**. Lüneburger Heide, Soltau, 1.viii.1967, on *Pinus sylvestris*, *M. Skytte Christiansen 67247* (NY). West Berlin, Waldfriedhof Zehlendorf Cemetery, Zehlendorf, 28.vii.1987, on tree trunk, *W.R. Buck s.n.* (NY). **SWEDEN**. SKANE. Lund, Botanical Garden, 10.xi.1976, on deciduous trees, *O. Almborn s.n.* (NY). **U.S.A. ILLINOIS**. DUPAGE CO.: Morton Arboretum, N of Lisle, 4.ii.1987, on *Pseduolarix kaempferi*, *G. Wilhelm 14602* (NY, sterile).

2. *Lecanora simeonensis* K. Knudsen & Lendemer sp. nov.

Mycobank #512989.

Plate 2 (page 78).

Lecanorae strobilinae similis, sed thallus sorediatus, et acidum decarboxysquamaticum nullus.

Type: **U.S.A. CALIFORNIA**. SAN LUIS OBISPO CO.: San Luis Obispo Co.: San Simeon State Park, San Carpoforo Creek, south side, east of Highway 1, near 35°45'46"N, 121°19'21"W, 6 m,

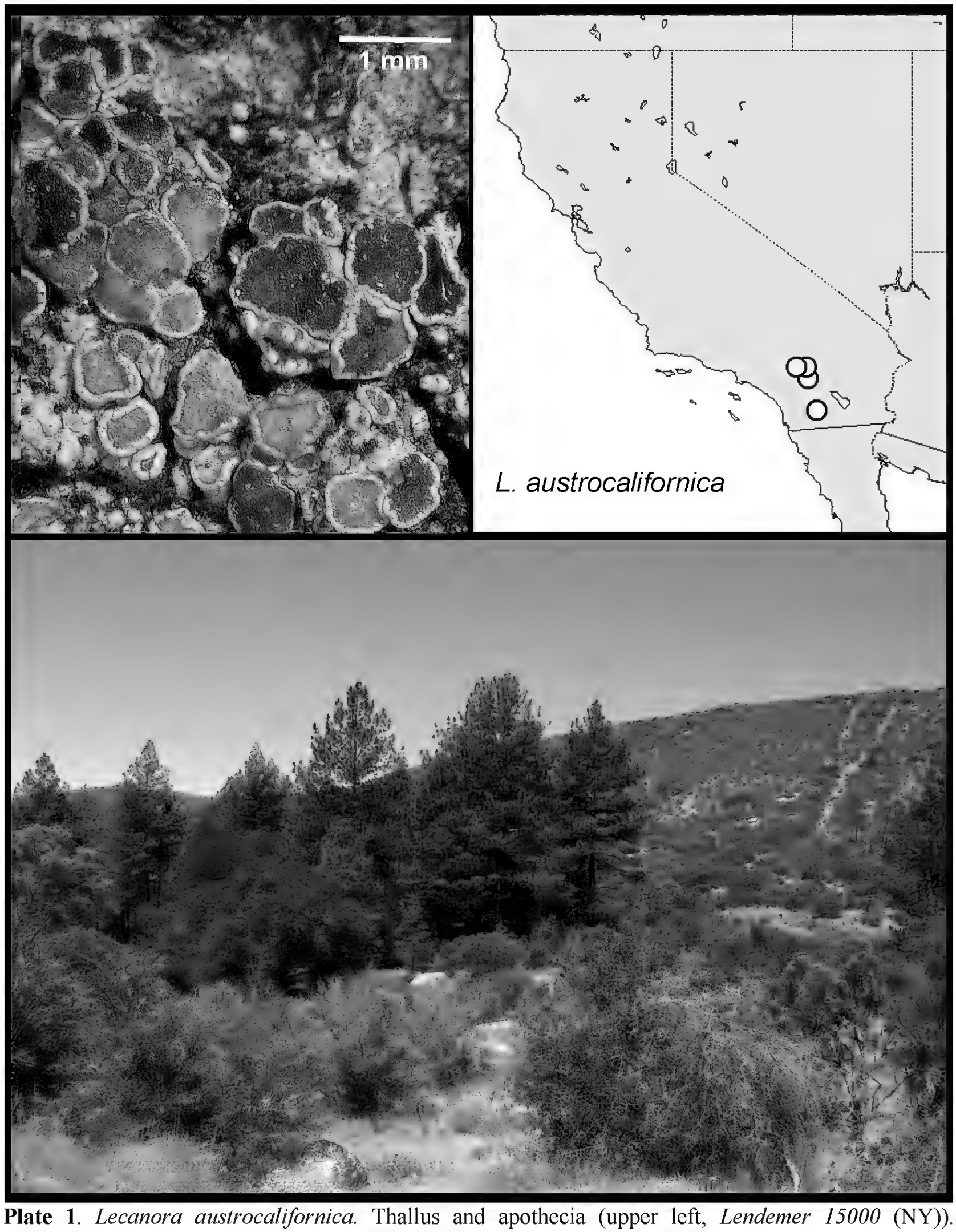

Plate 1. *Lecanora austrocalifornica.* Thallus and apothecia (upper left, *Lendemer 15000* (NY)). Geographic distribution as presently known (upper right). Habitat at Apple Canyon, San Jacinto Mountains, Riverside County, California (lower).

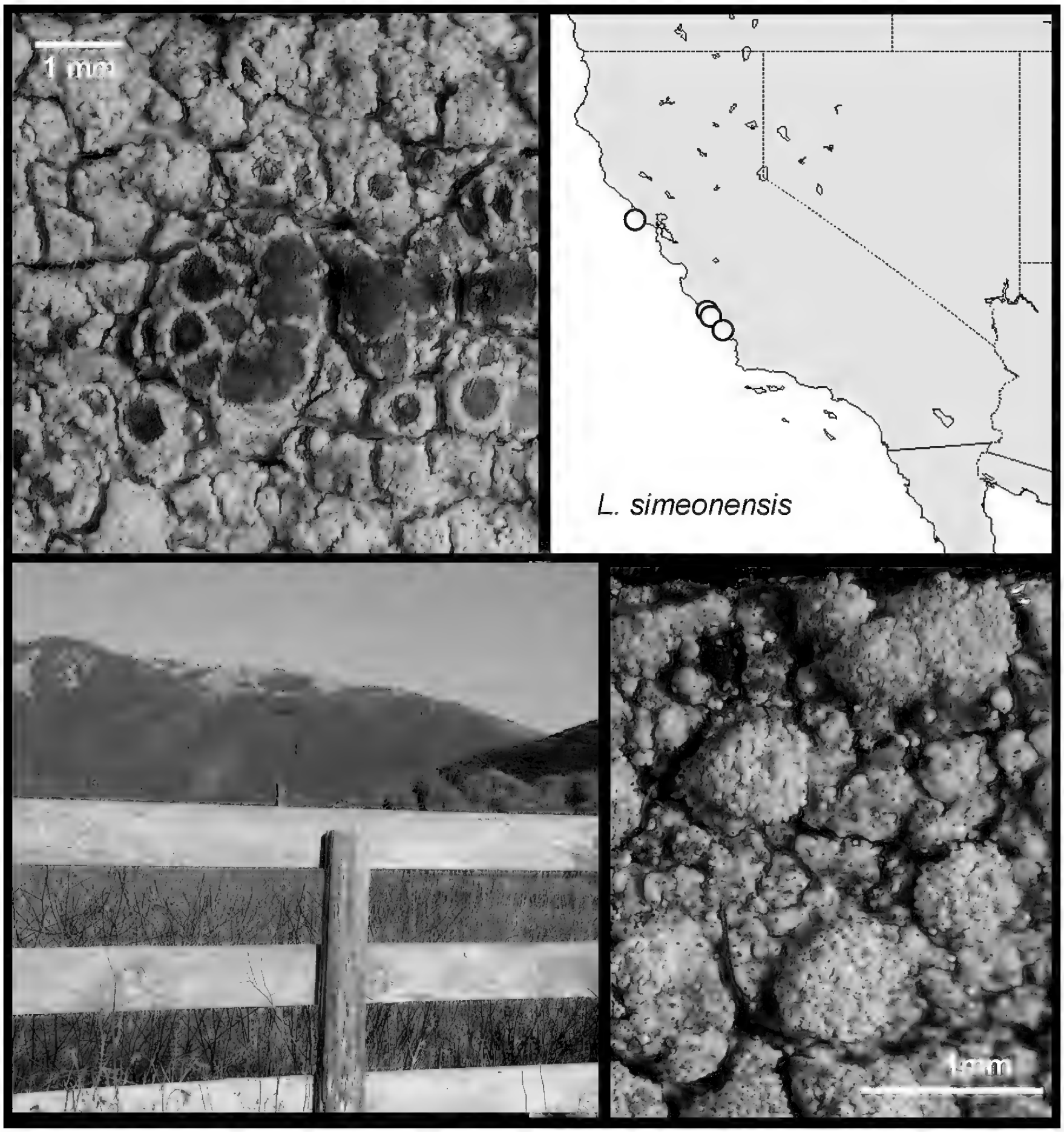

Plate 2. *Lecanora simeonensis*. Thallus with abundant apothecia (upper left, *Knudsen 9843* (NY)). Geographic distribution as presently known (upper right). Habitat at type locality in San Luis Obispo County, California (lower left). Thallus with deformed apothecia and well developed hemispherical soralia (lower right, *Knudsen 6467* (NY)).

on weathered conifer wood of abandoned corral, 19.vi.2006, *K. Knudsen 6467* (UCR, holotype [fertile]; NY, PRM, isotypes [sterile]).

DESCRIPTION. – Thallus yellow–beige, matt, warted–areolate, warts coalescing to form a rimose crust, sorediate, arising from a white prothallus, apothecia rare; warts irregular in shape, convex, often lumpy, sometimes incised, 0.1–0.4 mm across, in young thalli thin and dissolving into soredia; in older thalli erupting in capitate soralia or apothecia. Soredia yellow to green–tinged, usually occurring in capitate soralia, mostly 0.5 mm wide; young soredia mostly 0.01 mm in diameter, poorly differentiated, algae entwined with colorless hyphae 2 µm in diameter; older soredia in capitate soralia mostly 0.4–0.5 mm in diam., with 1 or 2 layers of paraplentenchymatous hyphae with cells mostly 2 µm in diam. enclosing an algal core. Cortex of paraplectenchyma, colorless, cells 8–10 µm wide; composed of 2–10 layers of hyphae. Medulla of colorless hyphae mostly 2 µm in diam. Algal layer +/– discontinuous. Strata only well–differentiated in older warts. Apothecia round, broadly attached, scattered or in small groups among soralia, or usually absent, maximum diam. 0.75 mm, most apothecia 0.3–0.5 mm; disc plane to convex, dark green or beige, often with +/– yellow pruina; margin thin to relatively thick, concolorous with thallus, becoming excluded when the apothecia become convex. Amphithecium colorless within, outer surface same color as disc, +/– with yellow pruina, 20–100 µm wide, of long–celled gelatinized radiating hyphae, branching, with narrow lumina, mostly 1 µm thick, to 5 µm in length, with +/– fine granules, in outermost layer apical cells often l–2 µm long and green–tinted; parathecium 10–20 µm or apparently lacking; hypothecium 90–100 µm high, colorless; subhymenium 30–40 µm, colorless; hymenium 50–70 µm colorless; epihymenium 10 µm high, sordid green, with +/– fine POL+ granules, green pigment diffuse and dissolving in K; paraphyses colorless, rarely branched, 1–1.5 µm wide, apical lumina usually ca. 1 x 1.5–3.0 µm wide, sometimes with green pigmented caps; asci 20–30 x 10–12 µm; ascospores 8 per ascus, colorless, simple, (11.7)–13.6–(16.2) x (3.4)–3.8–(4.1) µm (N=16). Pycnidia infrequent, immersed in thallus, walls brown. Conidia colorless, simple, filiform, slightly curved 13–14 x 1µm.

CHEMISTRY. – Usnic acid (cortex), zeorin (medulla). Spot tests: K–, C–, KC+ yellowish, P–, UV–.

ETYMOLOGY. – The epithet "simeonensis" refers to the type locality in San Simeon State Park, San Luis Obispo County, California.

ECOLOGY AND DISTRUBTION. – *Lecanora simeonensis* is a lignicolous species occuring in full sun at localities along the coast of central California. Currently the species is only known from Marin and San Luis Obispo Counties. The occurrence of *L. simeonensis* on wood fences and its apparent rarity suggest that anthropogenic change has reduced suitable substrate, possibly through clearance of land for cattle grazing or development or frequent fire.

DISCUSSION. – Among the usnic acid containing species of *Lecanora* in western North America, *Lecanora simeonensis* is a distinctive sorediate lignicolous species characterized by its warted areolate thallus, capitate soralia and chemistry. It is a member of the *L. strobilina* group which as characterized by Printzen (2001) is comprised of five species in which the amphithecium lacks a true cortex (*L. americana* (de Lesd.) Printzen, *L. confusa* Almb., *L. perconfusa* Printzen, *L. strobilina* (Spreng.) Kieff., and *L. substrobilina* Printzen). All members of this group treated by Printzen (2001), excluding *L. americana*, can also occur on wood in coastal habitats and at low elevations in western North America. However all of these species are esorediate and differ chemically in the production of decarboxysquamatic acid or xanthones.

The only other sorediate *Lecanora* with usnic acid and zeorin that has been reported from southern California is *Lecanora expallens* Ach., which produces the xanthone thiophanic acid in addition to the above substances. It is rare, having been collected only on the Channel Islands (Santa Cruz Island *fide* Ryan et al. (2004), and Santa Rosa Island (Knudsen, unpublished data)) and on fence posts in a lagoon in coastal San Diego County (Knudsen, unpublished data). Besides the differences in chemistry, *L. expallens* does not form capitate soralia and thus is not likely to be confused with *L. simeonensis*. In discussing *L. expallens,* Ryan et al. (2004) made reference to a collection from Santa Barbara County whose morphology corresponded to that of *L. expallens* but differed chemically in containing an unknown substance and lacking thiophanic acid. This report appears to refer to yet another unidentified sorediate species.

Lecanora oraefrigidae R. Sant. is another sorediate species of *Lecanora* that occupies a similar ecological niche outside of the Greater Sonoran Desert Region. This species, typically occurs on driftwood in maritime habitats of northern North America (boreal to sub–arctic) and also chemically differs from *L. simeonensis* in the production of xanthones in the thallus.

ADDITIONAL SPECIMEN EXAMINED. – **U.S.A. CALIFORNIA**. MARIN CO.: Point Reyes National Seashore, Bear Valley Visitor Center, 35°45'47"N, 121°19'19"W, 43 m, on old corral fences, 10.vii,2008, *K. Knudsen 9843 & J. Kocourková* (NY, PRM, UCR, fertile). SAN LUIS OBISPO CO.: San Simeon State Park, San Carpoforo Creek, south side, east of Hwy. 1, ca. 35°45'47"N, 121°19'19"W, 6 m, on weathered wood, plank from corral, 19.vi.2006, *K. Knudsen 6501.2* (UCR, sterile); San Simeon State Park, Arroyo de la Cruz, 35°42'31"N, 121°18'19"W, on wood fence, 10.ix.2008, *K. Knudsen 10243* (NY, UCR, fertile); Montana d'Oro, private property behind the Mansion, 35°17'51"N, 120°51'51"W, 86 m, on rotting oak log in *Arcotostaphylos morroensis–Quercus agrifolia* woodland, 8.i.2006, *K. Knudsen 4908 & S. Werth* (UCR).

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LITERATURE CITED

Ahti, T. 1965. Notes on the distribution of *Lecanora conizaeoides*. Lichenologist, 3(1): 91–92.

Brown, D.H. and R.M. Brown. 1968. The lichens of Blakeney Point, Norfolk. Lichenologist, 4(1): 1–15.

Culberson, C.F., and H. Kristinsson. 1970. A standardized method for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Griffin, J.R. 1993. Pinaceae. *In:* J.C., Hickman, (ed.): The Jepson Manual. Berkeley, California: University of California, pp. 115–122.

LaGreca, S. and B.W. Stutzman. 2006. Distribution and ecology of *Lecanora conizaeoides* (Lecanoraceae) in eastern Massachusetts. The Bryologist, 109(3): 335–347.

Laundon, J.R. 2003. Six lichens of the *Lecanora varia* group. Nova Hedwigia, 76(1–2): 83–111.

Printzen, C. 2001. Corticolous and lignicolous species of *Lecanora* (Lecanoraceae, Lecanorales) with usnic or isousnic acid in the Sonoran Desert Region. The Bryologist, 104(3): 382–409.

Purvis, O.W., B.J. Coppins, D.L. Hawksworth,P.W. James, and D.M. Moore (eds.) 1992. The Lichen Flora of Great Britain and Ireland. Natural History Museum Publications & British Lichen Society, London. 710 pp.

Ryan, B.D., H.T. Lumbsch, M.I. Messuti, C. Printzen, L. Śliwa, and T.H. Nash III. 2004. *Lecanora*. *In:* T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, F. Bungartz (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 176–286.

Śliwa, L. and C.M. Wetmore. 2000. Notes on the *Lecanora varia* group in North America. The Bryologist, 103(3): 475–492.

Thorne, R.F. 1977. Montane and subalpine forests of the Transverse and Peninsular Ranges *In:* Terrestrial Vegetation of California. Davis, California: University of California, pp. 537–558.

Opuscula Philolichenum, **6**: 81–86. 2009.

Lichens and related fungi of Highstead Arboretum, Fairfield County, Connecticut

Douglas Ladd[1], Richard C. Harris[2], William R. Buck[3]

ABSTRACT. – An inventory of the lichens at Highstead Arboretum in southwestern Connecticut documented 88 taxa of lichens and associated fungi. The lichen biota of the site is dominated by crustose taxa, and cyanolichens are notably absent. The lichens of the site have a strong preponderance of taxa with wide–ranging eastern temperate and pan–temperate biogeographic patterns, with minimal coastal plain influence. The sixth New England population of a regionally rare lichen, *Parmotrema reticulatum*, was discovered during this project, and 15 lichen taxa reported here are not listed in previous compilations of Connecticut lichens.

Introduction

Highstead Arboretum encompasses 58.4 hectares (146 acres) in the town of Redding in Fairfield County, the southwestern–most county in Connecticut. The site lies near the north–south midpoint of the Lower New England/Northern Piedmont Ecoregion, and is characterized by glaciated rolling uplands with predominately deciduous hardwoods. Founded in 1982, Highstead is located on lands that were subjected to a long history of agricultural activity and timber harvesting. In addition to open meadows and managed horticultural collections, there are significant areas of natural vegetation, which primarily consist of secondary forests.

Bedrock geology over most of the site is schist, with frequent boulders and outcrops. There is an area of granitic gneiss in the western part of the site. Both of these substrates are hard, acidic, nutrient–poor siliceous rocks. Elevation within Highstead ranges from 184 to 232 meters. A rocky ridge system in the western part of the site contains wooded uplands dominated by *Quercus coccinea*, *Q. prinus* and *Q. rubra*, with a prominent understory of *Kalmia latifolia*. The central part of the property is a low, shallow stream valley with a zone of swampy forest dominated by *Acer rubrum* and *Betula alleghaniensis*, with an abundance of *Clethra alnifolia, Lindera benzoin,* and *Symplocarpus foetidus* beneath. A mostly cleared drumlin on the east side of the property contains mixed hardwood stands of *Acer rubrum* and *Fraxinus americana,* with an understory of *Berberis thunbergii* and *Lindera benzoin*. Among the other trees present at the site are *Acer saccharum*, *Carya ovata, Liriodendron tulipifera*, and *Ostrya virginiana*.

In June 2005, the authors conducted an intensive one–day lichen survey at the site, working in all habitat types and areas of the site and attempting to examine all available substrates. The resultant list should be viewed as preliminary, but is of interest in profiling the lichens of a small scale woodland system in contemporary southwestern New England. Little modern information exists regarding Connecticut lichens, so this list provides a useful addition to the existing literature.

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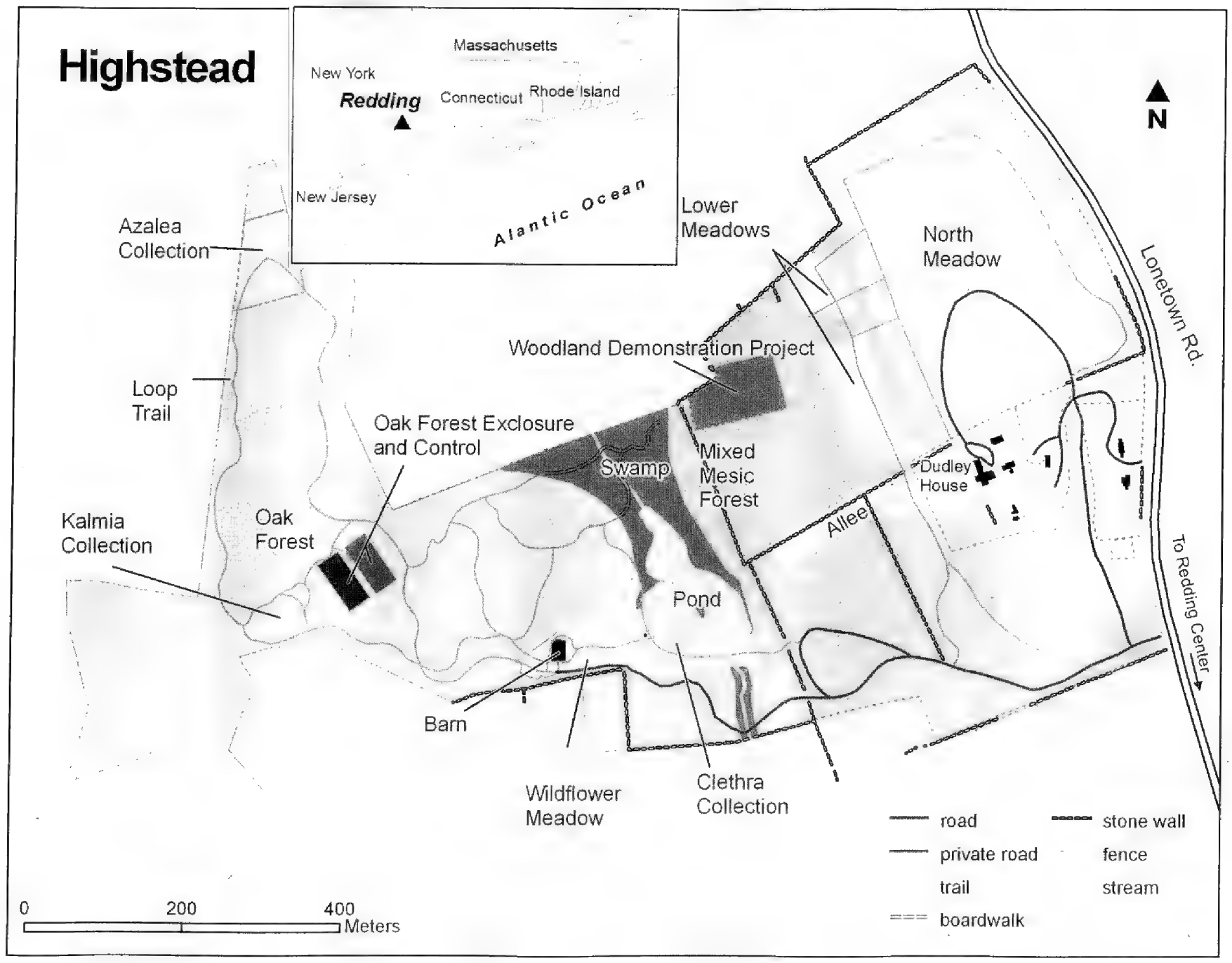

Figure 1. Map of Highstead Arboretum.

Annotated List

The following list enumerates the lichens documented from Highstead, with general comments about abundance and substrate affinities within the site. Collection numbers are prefixed with the first letter of the collector's last name (B, H or L). Buck and Harris collections are deposited at NY; Ladd collections will be deposited at NY. Based on its North American distribution, each taxon occurring at Highstead was assigned a biogeographic pattern, using the general biogeographic patterns of Brodo et al. (2001). These are indicated by a letter code following each entry in the list: ET – eastern temperate; PT – pan–temperate; PT(B) – pan–temperate with boreal affinities; BO – boreal; AGL – Appalachian/Great Lakes; CP – Atlantic and Gulf coastal plains. Lichen taxa with an asterisk are not reported in previous compilations of Connecticut lichens (Evans & Meyrowitz 1926, Feuerer 2008, Hinds & Hinds 2007, Lendemer & Harris 2004, Slack et. al. 1993).

Acarospora fuscata (Schrader) Th. Fr. – Frequent on exposed to lightly shaded boulders and outcrops. B49170, L27268; PT

Allocetraria oakesiana (Tuck.) Randlane & A. Thell – Uncommon on massive, shaded boulders in woodlands. H51537, L27281; AGL

Amandinea polyspora (Willey) E. Lay & P. May – Known from various corticolous substrates, including shaded twigs of *Kalmia latifolia* in a wooded upland and the bole of a large *Acer rubrum* in a wooded swampy depression. B49171, B49172, B49204, L27307, L27330; ET

Anaptychia palmulata (Michx.) Vain. – Known only from mossy bases and lower boles of large *Betula alleghaniensis* trees in a wooded swampy depression. L27326; AGL

Anisomeridium polypori* (Ellis & Everhart) M.E. Barr – Uncommon on hardwood boles in woodlands. B49205; ET

Arthonia caesia (Flotow) Körb. – Locally frequent on shaded boles and branches of hardwoods. B49206, H51592; ET

Aspicilia cinerea (L.) Körb. – Occasional on large boulders in woodlands. L27269; PT

Aspicilia laevata (Ach.) Arnold – Frequent in woodlands; on shaded outcrops and large boulders. B49169, H51538; PT

Biatora longispora (Degel.) Lendemer – Occasional on hardwood boles in woodlands; typically occurring as small, easily overlooked thalli. B49207, L27301; BO

Candelaria concolor (Dicks.) Stein – Infrequent on branches and boles of hardwoods. H51593; PT

Chrismofulvea dialyta (Nyl.) Marbach – Known from oak lignum in a woodland. This species was formerly called *Buellia dialyta* (Nyl.) Tuck. B49173; PT

Cladonia cylindrica (A. Evans) A. Evans – Uncommon on shaded decorticate hardwood logs in woodlands. H51539; ET

Cladonia grayi G. Merr. *ex* Sandst.– Common on lightly shaded boulders, outcrops, soil, and among mosses over soil in woodlands. All Highstead specimens that were tested contained fumarprotocetraric acid. H51540, H51541, L27270; PT

Cladonia macilenta Hoffm. var. ***macilenta*** – Frequent on exposed to lightly shaded boulders and outcrops in wooded uplands, sometimes growing over thin humus accumulations. H51542, H51543, H51544, L27267; PT(B)

Cladonia ochrochlora Flörke – Known from soil and humus along a road. H51545; BO

Cladonia parasitica (Hoffm.) Hoffm. – Occasional on rotting, decorticate hardwood logs and stumps in woodlands. B49174, L27294; ET

Cladonia petrophila* R.C. Harris – Uncommon on shaded boulders in woodlands, usually on vertical faces. H51547; ET

Cladonia pleurota (Flörke) Schaer. – Uncommon on lightly shaded rocks in wooded uplands. H51548; PT

Cladonia rei Schaer. – Local on thin soils over massive, lightly shaded outcrops. H51550; PT(B)

Cladonia squamosa Hoffm. – Uncommon on lightly shaded, massive boulders. H51551, L27279; PT(B)

Cladonia subcariosa Nyl. – Local in exposed well–drained rocky soil. This collection is the norstictic acid element that has been called *Cladonia polycarpoides* Nyl. H51549; ET

Cladonia subtenuis (Abbayes) Mattick – Occasional in well–drained, acidic soils and humus, typically over massive rock expanses. H51552, L27291; ET

Cladonia uncialis (L.) F.H. Wigg. – Local in well–drained, sterile, rocky, acidic soils over bedrock in woodland openings. L27292; PT(B)

Dermatocarpon luridum (With.) J.R. Laundon – Known from wet rocks in a small stream. B49208; PT(B)

Dibaeis baeomyces (L.f.) Rambold & Hertel – Locally frequent on exposed to lightly shaded, well–drained soils. H51553, L27260; PT(B)

Dictyocatenulata alba Finley & E.F. Morris – Known from the shaded base of a large *Quercus rubra* along a woodland edge. B49209, L27320; ET

Dimelaena oreina (Ach.) Norman – Occasional on exposed to lightly shaded boulders and outcrops in wooded uplands. B49175; PT

Distopyrenis americana* Aptroot – Known from a single collection, on *Betula lenta*. H51594; ET

Epicoccum purpurascens Schltdl. – Collected once on hardwood branches at the edge of a woods. B49211; ET

Flavoparmelia baltimorensis (Gyeln. & Fóriss) Hale – Common on lightly shaded boulders and outcrops. B49176, H51554, L27275; PT

Flavoparmelia caperata (L.) Hale – Frequent in woodlands; on lower and mid boles of mature hardwoods, especially *Quercus prinus*. H51555, L27312; PT

Fuscidea arboricola Coppins & Tønsberg – Apparently uncommon or overlooked; collected on *Betula lenta*. H51556; BO

Graphis scripta (L.) Ach. – Common on shaded boles of hardwoods in woodlands; *Acer saccharum*, *Betula lenta* and *Carya ovata* are common substrates. H51557, H51595; PT

Hypocenomyce scalaris (Ach. *ex* Lilj.) M. Choisy – Known from an old conifer stump in a wooded upland. H51558; PT(B)

Hypogymnia physodes (L.) Nyl. – Despite its regional abundance, at Highstead this lichen is known from only a few small populations on lightly shaded hardwood branches, and one population on a shaded boulder where it was associated with *Allocetraria oakesiana*. L27283; PT(B)

Hysterographium mori (Schw.) Rehm – Known from the bole of a dead *Acer rubrum*. H51591; PT

Imshaugia aleurites (Ach.) S.L.F. Mey. – Uncommon on old conifer stumps in woodlands. H51559; PT(B)

Lasallia papulosa (Ach.) Llano – Frequent on massive, lightly shaded boulders and outcrops. B49177, L27272; PT

Lecanora subpallens Zahlbr. – Uncommon on lightly shaded boles of hardwoods, typically *Quercus*, in woodlands. H51560; CP

Lecanora thysanophora R.C. Harris – Occasional on bases and boles of mature hardwoods in woodlands. B49178, H51561, L27310; ET

Lecidea cyrtidia Tuck. – Occasional on shaded outcrops in woodlands. B49179, B49180, H51562; ET

Lecidea plebeja* Nyl. – Uncommon on shaded lignum of fallen decorticate hardwood logs. B49181; ET

Lepraria caesiella* R.C. Harris – Occasional on shaded hardwood boles, especially *Betula alleghaniensis*; the Harris collection is from rock. B49182, H51563, L27305; ET

Lepraria caesioalba (de Lesd.) J.R. Laundon – Uncommon on massive, lightly shaded outcrops and hardwood boles. H51564, H51565; ET

Lepraria eburnea* J.R. Laundon – Known from the shaded base of *Betula lenta*. H51566; PT(B)

Lepraria lobificans Nyl. – Frequent in deeply shaded habitats, typically in somewhat mesic conditions, on sheltered rock faces, tree bases, and overhung mossy soil faces. H51567; PT

Lepraria neglecta (Nyl.) Erichsen – Known from the lightly shaded bole of *Betula lenta*. H51568; AGL

Loxospora pustulata (Brodo & W.L. Culb.) R.C. Harris – Known only from shaded boles of *Betula alleghaniensis* in a wooded swampy depression. L27327; ET

Micarea erratica* (Körb.) Hertel, Rambold & Pietschm. – Infrequent on exposed to lightly shade boulders and outcrops. B49184, H51569; ET

Micarea peliocarpa (Anzi) Coppins & R. Sant. – Occasional on stumps and fallen logs in woodlands. B49185, B49186; ET

Myelochroa aurulenta (Tuck.) Elix & Hale – Occasional in woodlands; on shaded rocks and shaded lower boles and bases of hardwoods. H51596, L27299; PT

Ochrolechia arborea (Kreyer) Almb. – Uncommon on shaded boles of *Betula alleghaniensis* in a swampy woodland. L27325; PT(B)

Ochrolechia yasudae* Vain. – Infrequent in woodlands, on lightly shaded boulders and outcrops. B49187, H51570; AGL

Parmelia squarrosa Hale – Known from the lightly shaded bole of *Carya ovata* in a wooded upland, and from the shaded bole of a small *Acer rubrum* in a wooded swampy depression. L27302B, L27322; PT(B)

Parmelia sulcata Taylor – Occasional on boles and larger branches of hardwoods and conifers. L27302A; PT

Parmotrema reticulatum (Taylor) M. Choisy – Known only from the lower bole of *Acer rubrum* in a shaded swampy depression. Hinds and Hinds (2007) ranked this lichen as regionally rare, with only five other records known from New England. L27323; PT

Peltigera didactyla (With.) J.R. Laundon – Uncommon in well–drained, lightly shaded soil among sparse vascular vegetation. H51571; PT(B)

Pertusaria pustulata (Ach.) Duby – Infrequent on lightly shaded boles of hardwoods, especially *Carya ovata*, in wooded uplands. H51597, H51598, L27300; ET

Phaeocalicium polyporaeum (Nyl.) Tibell – Known from thalli of Turkeytail Fungus (*Trichaptum biforme*) growing on fallen hardwood logs in woodlands. B49210; ET

Phaeophyscia rubropulchra (Degel.) Essl. – Common on boles and bases of hardwoods, typically in shaded conditions, and also on shaded, typically somewhat mossy, boulders. H51572; ET

Physcia millegrana Degel. – Local on branches of *Quercus* and *Kalmia latifolia*, but probably more common than initial impressions indicate. H51599, L27306; ET

Physcia stellaris (L.) Nyl.– Frequent on exposed branches and twigs of hardwoods. L27324; PT

Physcia subtilis Degel. – Frequent on lightly shaded boulders and outcrops in wooded uplands. H51573, L27285; ET

Polysporina simplex (Davies) Vězda – Uncommon and local on exposed cobbles and boulders. H51574; PT

Porpidia albocaerulescens (Wulfen) Hertel & Knoph – Frequent on shaded boulders, often in somewhat mesic habitats. B49188, H51575, L27278; ET

Porpidia crustulata (Ach.) Hertel & Knoph – Occasional on exposed to lightly shaded outcrops. B49189; PT

Porpidia subsimplex* (H. Magn.) Fryday – Occasional on exposed to lightly shaded outcrops and boulders (= *P. tahawasiana* Gowan). B49190, B49191; AGL

Punctelia rudecta (Ach.) Krog – Frequent on exposed to shaded boles of hardwoods and, less commonly, conifers, as well as occasionally on lightly shaded boulders in woodlands. H51576, H51577, L27321; ET

Punctelia "subrudecta" auct. amer. – Uncommon on lightly shaded boles of large *Quercus prinus* in wooded uplands; also on *Kalmia latifolia*. This material may be referable to *P. perreticulata* (Räsänen) G. Wilh. & Ladd (sensu Hinds & Hinds 2007), but seems sufficiently distinct from the Midwestern expression of that taxon as to warrant provisional segregation. H51578, H51579, L27315; PT

Pyrenula pseudobufonia (Rehm) R.C. Harris – Uncommon on lightly shaded boles of hardwoods, especially *Carya ovata* and *Quercus rubra*. L27298; ET

Pyrrhospora varians (Ach.) R.C. Harris – Occasional on exposed hardwood branches and boles, typically in disturbed areas or along woodland edges. H51580, H51581, L27309, L27319; ET

Rhizocarpon infernulum (Nyl.) Lynge f. ***sylvaticum*** Fryday – Local on siliceous boulders of an old stone wall in a low woodland. B49192, H51600, L27288; ET

Rhizocarpon obscuratum (Ach.) A. Massal. (= *R. reductum* Th. Fr.) – Known from lightly shaded boulders in woodlands. H51582; PT

Rhizocarpon rubescens Th. Fr. – Occasional on shaded boulders and outcrops in woodlands. B49193; ET?

Rinodina tephraspis* Tuck. – Occasional on lightly shaded boulders. B49194, L27274; ET

Ropalospora viridis* (Tønsberg) Tønsberg – Occasional on shaded hardwoods. B49195, H51583, H51601; PT(B)

Sarcogyne clavus (DC.) Kremp. – Common on exposed to lightly shaded, massive, outcrops and boulders. B49196; PT

Sarcogyne similis* H. Magn. – Occasional on exposed boulders and outcrops. L27271; PT

Scoliciosporum chlorococcum* (Stenh.) Vězda – Known from shaded crevices on the bole of a large *Quercus*. B49197; ET

Scoliciosporum umbrinum (Ach.) Arnold – Occasional on shaded boulders. H51584, L27276; ET

Thelocarpon superellum* Nyl. – Known from exposed soil along a roadbank. B49198; ET

Trapelia glebulosa (Sm.) J.R. Laundon – Occasional on lightly shaded cobbles and rocks, typically in sites with a history of disturbance. B49199, H51585; PT

Trapelia placodioides* Coppins & P. James – Occasional on shaded cobbles and boulders in woodlands. H51586, L27266; PT

Trapeliopsis flexuosa (Fr.) Coppins & P. James – Known from weathered cedar planks on the walkway of a foot bridge along a trail near the *Kalmia* grove. L27297; PT

Trypethelium virens Tuck. *ex* E. Michener – Uncommon; known from shaded boles of *Betula alleghaniensis* and *Carya*. H51602, L27328; ET

Umbilicaria mammulata (Ach.) Tuck. – Locally common on lightly shaded, massive boulders and outcrops in woodlands. B49200, L27286; AGL

Xanthoparmelia conspersa (Ehrh. *ex* Ach.) Hale – Common on exposed boulders and outcrops. H51587, L27265, L27277, L27290; PT

Xanthoparmelia viriduloumbrina (Gyeln.) Lendemer – Apparently uncommon; on shaded outcrops in woodlands. H51588; PT

Results & Discussion

A total of 88 taxa of lichens and related fungi was documented from Highstead Arboretum. Given the site's relatively small size and long history of anthropogenic perturbations, this level of diversity is significant, and verifies the high habitat diversity and presence of intact natural remnants within the site. Crustose lichens were the most common physiognomy represented, with 52 taxa (59%); 23 (26%) lichens were foliose and 13 (15%) were fruticose. Only one lichen, *Peltigera didactyla*, has a cyanobacterial

photobiont; cyanolichens typically found in mixed hardwoods in this region, such as various species of *Collema* and *Leptogium*, were conspicuously absent.

Available lichen substrates were limited to siliceous rocks, hardwoods and a few conifers, lignin, and soil. Despite their relative homogeneity (all siliceous and acidic), saxicolous substrates hosted 40 lichen taxa. Corticolous substrates also had 40 taxa, 11 lichens occurred on terricolous substrates, and 9 were found on lignicolous substrates.

From a biogeographic perspective, the lichen biota at Highstead is overwhelmingly wide–ranging: 89% of the taxa have biogeographic patterns characterized as either wide–ranging eastern temperate (34 taxa) or pan–temperate (44 taxa). Of the taxa with pan–temperate distribution patterns, a third have boreal affinities. Taxa with other biogeographic patterns are only minor components of the lichen diversity, with three boreal taxa, one coastal plain species, and six taxa associated with the Appalachian–Great Lakes element.

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Literature Cited

Brodo, I.M., S.D. Sharnoff and S. Sharnoff. 2001. Lichens of North America. New Haven, CT: Yale University Press. xxiv + 795 pp.

Evans, A.W. and R. Meyrowitz. 1926. Catalogue of the lichens of Connecticut. Hartford, CT: State Geological and Natural History Survey Bulletin 37. 56 pp.

Feuerer, T. (ed.). 2008. Checklists of lichens and lichenicolous fungi. Version 1, November 2008. *www.biologie.uni–hamburg.de/checklists/northamerica/usa_connecticut*

Hinds, J.W. and P.L. Hinds. 2007. The Macrolichens of New England. Memoirs of the New York Botanical Garden 96. 608 pp.

Lendemer, J.C. and R.C. Harris. 2004. A checklist of the lichens collected on the 28th A. Leroy Andrews Foray. Evansia 21: 88–100.

Slack, N., B.C. Tan and E. Lay. 1993. The bryophytes and lichens collected during the 16th A.L. Andrews Foray in northwestern Connecticut. Evansia 10: 9–12.

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Lichenicolous fungi and some lichens from the Holarctic

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ABSTRACT. – 102 species of lichenicolous fungi and 23 lichens are reported, mainly from the Russian Arctic. Four new taxa are described: *Clypeococcum bisporum* (on *Cetraria* and *Flavocetraria*), *Echinodiscus kozhevnikovii* (on *Cetraria*), *Stigmidium hafellneri* (on *Flavocetraria*) and *Gypsoplaca macrophylla* f. *blastidiata*. The following lichenicolous fungi are reported for the first time from North America: *Monodictys fuliginosa*, *Stigmidium microcarpum* and *Trichosphaeria lichenum*. The following lichenicolous fungi and lichens are reported as new to Asia: *Arthonia almquistii, Arthophacopsis parmeliarum, Cercidospora lobothalliae, Clypeococcum placopsiphilum, Dactylospora* cf. *aeruginosa, D. frigida, Epicladonia sandstedei, Everniicola flexispora, Hypogymnia fistulosa, Lecanora luteovernalis, Lecanographa rinodinae, Lichenochora mediterraneae, Lichenopeltella peltigericola, Lichenopuccinia poeltii, Lichenosticta alcicornaria, Phoma cytospora, Polycoccum ventosicola, Roselliniopsis gelidaria, R. ventosa, Sclerococcum gelidarum, Scoliciosporum intrusum, Stigmidium croceae, S. mycobilimbiae, S. stygnospilum, S. superpositum, Taeniolella diederichiana, Thelocarpon impressellum* and *Zwackhiomyces macrosporus*. Twenty-eight species are new to Russia, 15 new to the Arctic, five new to Mongolia and nine new to Alaska. Twenty lichen genera and 31 species are new hosts for various species of lichenicolous fungi.

Introduction

This paper deals chiefly with lichenicolous fungi of the Russian Arctic and thus continues the previous publications on the subject (mainly: Zhurbenko & Santesson 1996, Zhurbenko 2008a). The results of this study will be particularly helpful to those studying lichenicolous fungi of arctic regions that have been poorly explored and collected, such as North America, because many species likely have wide distributions reflecting the circumpolar distributions of their hosts. In addition to new and interesting reports of lichenicolous fungi data pertaining to some interesting lichen finds are also included.

Materials and Methods

Lichenicolous fungi were specifically searched for on the following hosts: parmelioid and cetrarioid lichens, *Arthrorhaphis, Baeomyces, Biatora, Brigantiaea, Bryocaulon, Bryodina, Bryonora, Bryoria, Buellia, Caloplaca, Candelariella, Catapyrenium, Dermatocarpon, Diploschistes, Fulgensia, Hypogymnia, Lecidoma, Lepraria, Lobaria, Lobothallia, Lopadium, Megaspora, Micarea, Mycobilimbia, Mycobilimbia, Nephroma, Ophioparma, Phaeorrhiza, Placopsis, Placynthium, Polyblastia, Protoblastenia, Protoparmelia, Psora, Solorina crocea,* and *Toninia*. In total about 500 specimens of lichenicolous fungi and lichens were studied. Most of specimens are housed in LE, however additional specimens in the following herbaria were also examined: M, TUR, herb. Diederich and herb. Zhurbenko.

The material was examined and photographed using Zeiss microscopes Stemi 2000–CS and Axio Imager A1 equipped with Nomarski differential interference contrast optics. Microscopical examination was done in water, 10 % KOH (K), phloxin (1% in water), lactophenol cotton blue (LCB), Melzer's reagent

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(MLZ), Lugol's iodine, directly (I) or after a KOH pre–treatment (K/I), Brilliant Cresyl blue (BCr) or Congo red (CR) solutions. The length, breadth and length/breadth ratio (l/b) of asci and ascospores are given as: (min–){$\overline{X}$–SD}–{$\overline{X}$+SD}(–max), where min and max are the extreme values, $\overline{X}$ the arithmetic mean, and SD the corresponding standard deviation. Microscopical measurements were made in water, unless otherwise indicated. Sizes of asci were rounded to the nearest 1 μm, those of ascospores to the nearest 0.5 μm. Terms for simple plane shapes and colors mostly follow Stearn (1992: 539) and Petersen (1996), respectively. Authors of host lichens are omitted.

Catalogue

Abbreviations: ap. – apothecia, Is. – Island, M. Z. – M. Zhurbenko, Mt(s). – Mountain(s), Pen. – Peninsula, th. – thallus. Lichens are designated by "*".

1. *Abrothallus cladoniae* R. Sant. & D. Hawksw.

Notes. – Apothecia convex to applanate, constricted at the base, sessile, dark sepia to blackish, epruinose, up to 0.25 mm diam. Epithecium olive–brown, K+ blue–green; hypothecium dark olive–brown. Ascospores pale to medium olive–brown, soleiform, 1–septate, constricted at the septum, easily disintegrating into 2 cells, (6–)6.5–8.5(–9) × 3–3.5(–4) μm (n=21), finely verruculose, overlapping biseriate in the ascus. Pathogenic effect not observed. The specimen slightly differs from the protologue of *Abrothallus cladoniae* (Hawksworth 1990), where its apothecia are said to often be shortly stipitate and densely green pruinose, hypothecium brown, ascospores 7–11 × 3–4.5 μm and the fungus is said to decolorize podetia of *Cladonia* (Hawksworth 1990). New to Alaska.

Specimen Examined. – **U.S.A. Alaska.:** Kobuk Valley Wilderness, 67°07'N, 159°03'W, alt. 50 m, *Picea glauca* forest, on *Cladonia pyxidata* (podetia), 8.viii.2000, *M. Z. 00457* (LE 233620).

2. *Abrothallus parmeliarum* (Sommerf.) Arnold

Notes. – *Abrothallus parmeliarum* has often been considered to be restricted to *Parmelia* s. str. (e. g., see Hafellner 1998, Diederich 2003). However, according to Ave Suja (pers. comm.), this species has a wider host range. Ascospores of specimens on *Parmelia* are (12–)13–17(–19) × (5–)5.5–7(–8) μm (n= 61) and those on *Asahinea* are (13–)14.5–17(–20) × (4.5–)5.5–7(–8) μm (n=28). *Asahinea* is a new host genus for *Abrothallus* it is also the first report of a lichenicolous fungus on *Asahinea*.

Specimens Examined. – **RUSSIA. Murmansk Region:** Tumannyi, 69°01'N, 35°48'E, alt. 150 m, sparse *Betula* forest, on *Melanohalea septentrionalis* (on galls induced by *Phacopsis oxyspora*), 19.viii.1997, *M. Z. 97343:a* (LE 233260:a); Kolvitsa, 67°05'N, 32°59'E, on boulder among meadow, on *Parmelia saxatilis* (th.), 12.viii.1975, *A. Dombrovskaya* (LE 233270). **Yamal Pen.:** Neromayakha River, 70°10'N, 69°10'E, tundra, on *P. omphalodes* ssp. *glacialis* (th.), 16.vii.1990, *O. Khitun* (LE 233380). **Taimyr Pen.:** Dikson Is., 73°30'N, 80°20'E, alt. 30 m, boulder field in tundra, on *P. omphalodes* ssp. *glacialis* (th.), 7.vii.1990, *M. Z. 90368:b* (LE 207697:b); Bol'shaya Bootankaga River, 74°17'N, 98°04'E, stony tundra, on *Asahinea scholanderi* (th.), 8.vii.1991, *V. Kuvaev* (LE 233021); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, tundra, on *A. scholanderi* (th.), 29.vii.1995, *M. Z. 95339* (LE 232972); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 50 m, tundra, on *P. sulcata* (th.), 31.vii.1995, *M. Z. 95351* (LE 233309); Bikada River, 74°50'N, 106°30'E, tundra, on *P. omphalodes* (th.), vii.1989, *E. Pospelova* (LE 233159). **Yakutiya:** Lena River delta, Cape Krest–Tumsa, 72°22'N, 126°42'E, alt. 50 m, tundra, on *P. omphalodes* (th.), 4.viii. 1998, *M. Z. 98292* (LE 233239); Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 100 m, tundra, on *P. omphalodes* (th.), 18.vii.1998, *M. Z. 98293* (LE 233229). **Chukotka:** Lavrentiya Bay, 65°35'N, 171°00'W, boulder field in tundra, on *P. omphalodes* (th.), 29.vii.1973, *I. Makarova* (LE 233269:a); Bezymyannoe Lake, 66°39'N, 176°40'E, stony tundra, on *P. omphalodes* (th.), 9.vii.1979, *I. Makarova* (LE 233179). **Altai:** Seminskii Pass, 51°05'N, 85°39'E, alt. 1350 m, coniferous forest, on *P. sulcata* (th.), 16.viii.2008, *E. Popov* (LE 247850).

3. *Abrothallus prodiens* (Harm.) Diederich & Hafellner

Note. – Previously known in Siberia, and probably Asia, only from vicinities of Khanty–Mansiisk (Vainio 1928).

Specimen Examined. – **RUSSIA. Western Siberia:** Verkhnii Taz Upland, Ratta River, 63°30'N, 83°55'E, alt. 100 m, *Pinus* forest, on *Hypogymnia physodes* (th.), 7.viii.1997, *A. Dobrysh* (LE 233167).

4. *Arthonia almquistii* Vain.

Note. – Causes local discoloration of the host tissues. New to Asia.

Specimen Examined. – **RUSSIA. Chukotka:** Puoten Bay, 65°50'N, 170°30'W, stony tundra, on *Amygdalaria panaeola* (th.), 23.vii.1972, *I. Makarova* (LE 232861).

5. *Arthonia* cf. *epiphyscia* Nyl.

Notes. – Causes local discoloration of the host tissues. New to Asia.

Specimens Examined. Both specimens on *Phaeorrhiza sareptana* var. *sphaerocarpa* (th., sometimes ap.). **–RUSSIA. Yakutiya:** junction of Indigirka and In'yali Rivers, 65°10'N, 143°10'E, alt. 450 m, steppe–like vegetation among *Larix* forest, 17.vi.1976, *I. Makarova* (LE 233202:a). **Chukotka:** Enmyvaam River, 68°15'N, 166°03'E, tundra, 30.vi.1980, *I. Makarova* (LE 233232).

6. *Arthonia excentrica* Th. Fr.

Notes. – Sometimes induces gall–like swellings of the host thallus. All specimens in tundra on thalli of unidentified species of *Lepraria*, unless otherwise indicated.

Specimens Examined. – **Murmansk Region** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field, on *Lepraria neglecta* group, 22.vii.1997, *M. Z. 97348* (LE 233278); Shel'pino Bay of Barents Sea, 69°05'N, 36°12'E, alt. 10 m, coastal cliffs, 4.ix.1997, *M. Z. 97350* (LE 233289); Barents Sea coast at Olenka River mouth, 69°02'N, 36°24'E, alt. 50 m, 6.ix.1997, *M. Z. 97351* (LE 233268). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 200–300 m, 22.vii.1995, *M. Z. 95364* (LE 233224); 24.vii.1995, *M. Z. 95359* (LE 233307); 25.vii.1995, *M. Z. 95358:b* (LE 233257:b); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–250 m, 28.vii. 1995, *M. Z. 95363* (LE 233196); 29.vii.1995, *M. Z. 95368* (LE 233187); 28.viii.1995, *M. Z. 95362* (LE 233157), *M. Z. 95367* (LE 233197); NW coast of Pyasino Lake, 70°00'N, 87°30'E, alt. 80 m, boulder field, on *L. neglecta* group, 24.vii.1983, *M. Z. 83108* (LE 233318). **Yakutiya:** Lena River delta, Amerika–Khaya hill, 72°35'N, 126°18'E, alt. 50 m, 23.vii.1998, *Yu. Cherkasova* (LE 233327); 30.vii.1998, *M. Z. 98295* (LE 233337); same delta, Cape Krest–Tumsa, 72°22'N, 126°42'E, alt. 50 m, 4.viii.1998, *M. Z. 98296* (LE 233237). **Wrangel' Is.:** Gusinaya River, 71°10'N, 179°10'E, 16.vii.1979, *T. Polozova* (LE 233277:a); Neizvestnaya River, 71°11'N, 179°15'W, 1996, *S. Kholod* (LE 233206). **Chukotka:** Bezymyannoe Lake, 66°39'N, 176°40'E, 11.vii.1979, *I. Makarova* (LE 233396:a); Kolyuchin Is., 67°26'N, 174°40'W, 5.viii.1969, *T. Plieva* (LE 233356); Ioni Lake, 65°53'N, 173°44'W, 7.vii.1977, *I. Makarova* (LE 233216).

7. *Arthonia molendoi* (Frauenf.) R. Sant.

Note. – Causes local discoloration of the host tissues.

Specimen Examined. – **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 250 m, Ca–rocks, on *Caloplaca saxicola* (ap. – hymenium), 20.viii.1995, *M. Z. 95323* (LE 233023).

8. *Arthonia peltigerina* (Almq.) H. Olivier

Notes. – Usually associated with moribund discolored parts of the host lobes. All specimens on *Solorina crocea* (both sides of lobes, often along the margins).

Specimens Examined. – **RUSSIA. Nenetz Region:** Bol'shezemel'skaya Tundra, Ortin River, 67°59'N, 54°03'E, tundra, 29.vi.1999, *O. Lavrinenko* (LE 233096). **Severnaya Zemlya:** Bol'shevik Is., Ostraya Mt., 79°11'N, 102°09'E, alt. 200 m, polar desert, 11.vii.1996, *M. Z. 96904* (LE 233076), *M. Z. 96905* (LE 232807); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 20 m, polar desert, 17.vii.1996, *M. Z. 96902: b* (LE 233066:b). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 450 m, tundra, 10.viii.1995, *M. Z. 95285* (LE 233056).

9. *Arthophacopsis parmeliarum* Hafellner

NOTES. – New to the Arctic, Asia and Russia. *Parmelia omphalodes* is a new host species.

SPECIMENS EXAMINED. – **RUSSIA. CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, boulder field in tundra, on *Parmelia saxatilis* (th.), 29.vii.1973, *I. Makarova* (LE 233360:a); on *P. omphalodes* (th.), 29.vii.1973, *I. Makarova* (LE 232945).

10. *Arthrorhaphis alpina* (Schaer.) R. Sant.*

SPECIMEN EXAMINED. – **RUSSIA. PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 600 m, subalpine belt, on *Baeomyces placophyllus* (th.), 18.viii.1983, *M. Z. 83228* (LE 233254).

11. *Arthrorhaphis vacillans* Th. Fr.*

SPECIMEN EXAMINED. – **RUSSIA. YAKUTIYA:** lower Lena River, Tit–Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest–tundra, on loamy soil and *Baeomyces rufus* (th.), 20.viii.1998, *M. Z. 98305* (LE 233234).

12. *Biatorella contigua* N. S. Golubk. & Piin*

NOTES. – This terricolous lichen is known from a few finds in the Arctic from Taimyr, Severnaya Zemlya and Alaska (Piin 1977, Zhurbenko & Gavrilo 2005, Zhurbenko et al. 2005). New to Yakutiya.

SPECIMEN EXAMINED. – **RUSSIA. YAKUTIYA:** Lena River delta, Cape Krest–Tumsa, 72°22'N, 126°42'E, alt. 50 m, *Dryas*–lichen–moss tundra, on sandy soil with moss remnants, 4.viii.1998, *M. Z. 98314* (herb. Zhurbenko).

13. *Buellia elegans* Poelt*

NOTE. – New to the Russian Arctic.

SPECIMENS EXAMINED. All specimens on Ca–soil; filed under *Lichenostigma semiimmersum*. – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, tundra on limestone hill, 1.viii.1995, *M. Z. 95390* (LE 233344). **YAKUTIYA:** Lena River between Sinsk and Tit–Ary, 61°04'N, 127°29'E, alt. 150 m, Ca–rocks with steppe–like vegetation, 4.vii.1992, *M. Z. 92392* (LE 233354); Indigirka River, 65°48'N, 142°53'E, alt. 250 m, forested (*Larix*) Ca–rocks, 20.vii.1992, *M. Z. 9283* (LE 233324).

14. *Caloplaca psoricida* E.S. Hansen, Poelt & Søchting*

NOTES. – Previously known only from Greenland and Severnaya Zemlya (Hansen et al. 1987, Zhurbenko & Matveeva 2006). It is distinguished from *Caloplaca ammiospila* (Wahlenb.) H. Olivier mainly by the strictly lichenicolous habitat on *Psora rubiformis*. However, *C. ammiospila* also occurs on a wide range of lichen genera, including *Collema, Fuscopannaria, Lecidea*, *Pannaria*, *Parmelia, Peltigera*, *Pertusaria, Phaeorrhiza, Rinodina*, *Sphaerophorus* and *Stereocaulon* (Zhurbenko 2008b), hence the distinction between these species needs confirmation.

SPECIMENS EXAMINED. Both specimens in rocks among tundra on *Psora rubiformis* (th.). – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–250 m, 28.vii.1995, *M. Z. 95294:a* (LE 232946:a); 30.vii.1995, *M. Z. 95295:a* (LE 232936:a).

15. *Candelariella arctica* (Körb.) R. Sant.*

NOTE. – This is the first verified report of *Candelariella arctica* for the Russian Arctic (Andreev et al. 1996).

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Inchoun, 66°15'N, 170°20'W, on coastal rocks, 29.vii.1975, *I. Makarova* (filed under *Intralichen christiansenii*, LE 232873).

16. *Candelariella vitellina* (Hoffm.) Müll. Arg.*

NOTE. – The only *Candelariella* species previously reported as lichenicolous on *Placynthium* was *C. aurella* (Hoffm.) Zahlbr. often reported as its synonym *C. dispersa* (Räsänen) Hakul. (e. g., see Hansen 2002).

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Ioni Lake, 65°53'N, 173°44'W, stony tundra, on *Placynthium asperellum* (th.), 5.vii.1977, *I. Makarova* (LE 233282).

17. *Carbonea vitellinaria* (Nyl.) Hertel

SPECIMENS EXAMINED. – **RUSSIA. TAIMYR PEN.** (all in tundra): N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 180–400 m, on *Candelariella placodizans* (th.), 20.vii.1995, *M. Z. 95315* (LE 233083); on *C. placodizans* (th.), 25.vii.1995, *M. Z. 95318* (LE 232805); alt. 180 m, on *C. vitellina* (th.), 26.viii.1995, *M. Z. 95317* (LE 232815); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–250 m, on *C. placodizans* (th.), 28.vii.1995, *M. Z. 95316* (LE 233093); on *C. placodizans* (th.), 30.vii.1995, *M. Z. 95320* (LE 232903); on *C. placodizans* (th.), 28.viii.1995, *M. Z. 95314* (LE 232973). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 600 m, rocks in subalpine belt, on *C. placodizans* (th.), 21.vii.1985, *M. Z. 8550* (LE 232963); alt. 1000 m, mountain tundra, on *C. placodizans* (th.), 20.viii.1983, *M. Z. 83217* (LE 233013). **CHUKOTKA:** (all in tundra): Baranikha, 68°30'N, 168°16'E, scree, on *C. vitellina* (th.), 16.vi.1971, *I. Makarova* (LE 233043); Amguema River, 67°41'N, 178°35'W, rocks, on *C. vitellina* (th.), 8.viii.1979, *I. Makarova* (LE 233003); Iskaten' Range, 66°35'N, 179°10'W, stones, on *C. vitellina* (th.), 2.vii.1971, *I. Makarova* (LE 232883); Lavrentiya Bay, 65°35'N, 171°00'W, on *C. placodizans* (th.), 16.vii.1973, *I. Makarova* (LE 232913); Uelen, 66°20'N, 169°55' W, on *C. placodizans* (th.), 8.viii.1975, *I. Makarova* (LE 232893).

18. *Cercidospora* cf. *lecidomae* Zhurb. & Triebel

NOTES. – Associated with discolored, often marginal, parts of the host thalli. This fungus was previously known only on *Lecidoma demissum*. However, the specimens studied fit its protologue well (Zhurbenko & Triebel 2003). *Cercidospora lecidomae* is close to *C. punctillata*, a variable species colonizing a wide range of lichen genera. Further studies are needed to confirm their taxonomic separation.

SPECIMENS EXAMINED. – **RUSSIA. SEVERNAYA ZEMLYA:** (polar desert) Bol'shevik Is., Ostantsovaya River, 79°13'N, 102°02'E, alt. 60 m, on *Buellia insignis* (th.), 12.vii.1996, *M. Z. 96935* (LE 233244); same Is., Studenaya River, 78°37'N, 101°05'E, alt. 130 m, on *B. papillata* (th.), 16.viii.1998, *N. Matveeva* (LE 233385).

19. *Cercidospora lobothalliae* Nav.–Ros. & Calat.

NOTES. – Perithecia deeply immersed in the host tissues with only pores visible. Sometimes associated with discolored parts of the host. Previously known only from Spain, Greece and the USA (California) (Navarro–Rosines et al. 2004). New to the Arctic, Asia and Russia. *Lobothallia melanaspis* is a new host species.

SPECIMENS EXAMINED. All specimens on *Lobothallia melanaspis* (ap.: hymenium, th.). – **RUSSIA. SEVERNAYA ZEMLYA:** (polar desert) Bol'shevik Is., Mikoyan Bay, 79°18'N, 101°55'E, alt. 10 m, 21.vii.1996, *M. Z. 96922* (LE 233158), *M. Z. 96923* (LE 233178); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, ephemeral water tract, 16.vii.1996, *M. Z. 96921* (LE 233168).

20. *Cercidospora parva* Hafellner & Ihlen

NOTES. – Causes local darkening on the host thallus. According to the protologue of *Cercidospora parva* (confined to *Baeomyces*), this species is closely related to *C. trypetheliza* (on *Arthrorhaphis*) and differs from the latter in darker peridium pigment, narrower ascomata and asci and shorter ascospores (Ihlen 1998). However, my observations do not confirm these differences between the species. Considering that *Arthrorhaphis* often grows on *Baeomyces*, the distinction between *Cercidospora parva* and *C. trypetheliza* should be re–examined.

SPECIMEN EXAMINED. – **RUSSIA. TAIMYR PEN.:** NW coast of Pyasino Lake, 70°00'N, 87°30'E, alt. 80 m, shrub tundra, on *Baeomyces rufus* (th.), 8.viii.1999, *L. Zanokha* (LE 233214).

21. *Cercidospora punctillata* (Nyl.) R. Sant. s. l.

NOTES. – Almost always associated with discolored parts of host thalli and apothecia. Septation of the ascospores varies significantly in some specimens ascospores are mostly 3–septate. *Biatora* is a new host genus.

SPECIMENS EXAMINED. – **NORWAY. SVALBARD:** North–East Land, Murchison fjord, Nord Bay, 80°02'N, 18°49'E, alt. 100 m, on *Protopannaria pezizoides* (th.), 17.viii.2007, *N. Matveeva* (LE 232174). **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, on *Biatora cuprea* (on translucent film between verrucae), 22.viii.1997, *M. Z. 97354:b* (LE 233323:b). **SEVERNAYA ZEMLYA:** (polar desert) Oktyabr'skoi Revolutsii Is., Serp i Molot Mt., 79°45'N, 94°11'E, on *Solorina crocea* (th.), 17.vii.1985, *M. Gavrilo* (LE 232927); same Is., Krasnaya Bay, 79°42'N, 96°40'E, on *S. crocea* (th.), 6.viii.1985, *M. Gavrilo* (LE 232877); Bol'shevik Is., Cape Baranov, 79°16'N, 101°40'E, alt. 20 m, on *S. crocea* (th.), 10.vii.1996, *M. Z. 96893:a* (LE 232937:a); same Is., Ostantsovaya River, 79°13'N, 102°02'E, alt. 60 m, on *S. crocea* (th.), 12.vii.1996, *M. Z. 96896* (LE 232887); same Is., Ostraya Mt., 79°11'N, 102°09'E, alt. 200 m, on *S. crocea* (ap.: hymenium, th.), 11.vii.1996, *M. Z. 96901* (LE 232837), *M. Z. 96899* (LE 232827); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 10–450 m, on *S. crocea* (th., ap.), 16.vii.1996, *M. Z. 96897* (LE 232987); 17.vii.1996, *M. Z. 96902:a* (LE 233066:a); 18.vii.1996, *M. Z. 96895* (LE 232967); on *B. cuprea* (th.), 17.vii.1996, *M. Z. 96937:a* (LE 233223:a); 18.vii.1996, *M. Z. 96939* (LE 233253); same Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, on *Micarea assimilata* (th.), 6.viii.1997, *N. Matveeva* (LE 233156:a); on *M. incrassata* (th.), 1.ix.1998, *N. Matveeva* (LE 233366); on *B. subduplex* (ap.), 1.ix.1998, *N. Matveeva* (LE 233183). **TAIMYR PEN.:** (all in tundra): Sibiryakov Is., 72°50'N, 79°10'E, on *S. crocea* (th.), 14.vii.1990, *V. Kuvaev* (LE 233046); Uboinaya River mouth, 73°36'N, 82°22'E, alt. 20 m, on *S. crocea* (th.), 1.viii.1990, *M. Z. 90852* (LE 232897); Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 350 m, on *Phaeorrhiza nimbosa* (th.), 18.viii. 1995, *M. Z. 95401:a* (LE 233302:a); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 400 m, on *S. crocea* (th.), 20.vii.1995, *M. Z. 95283:a* (LE 233007:a); 10.viii.1995, *M. Z. 95284* (LE 232847). **YAKUTIYA:** Lena River delta, Novyi Chai–Tumus, 72°20'N, 125°40'E, alt. 30 m, tundra, on *S. crocea* (th.), 6.viii.1998, *M. Z. 98274* (LE 232867).

22. *Cercidospora trypetheliza* (Nyl.) Hafellner & Obermayer

SPECIMENS EXAMINED. – **RUSSIA. SEVERNAYA ZEMLYA:** Bol'shevik Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, polar desert, on *Arthrorhaphis vacillans* (th.), 25.viii.1998, *N. Matveeva* (LE 232991). **TAIMYR PEN.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 350 m, tundra, on *A. alpina* (th.), 16.viii.1995, *M. Z. 95340* (LE 232851). **YAKUTIYA:** lower Lena River, Tit–Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest–tundra, on *A. vacillans* (th.), 20.viii.1998, *M. Z. 98290* (LE 233091).

23. *Cercidospora verrucosaria* (Linds.) Arnold

SPECIMENS EXAMINED. All specimens on *Megaspora verrucosa* (ap.: thalline margins). – **RUSSIA. SEVERNAYA ZEMLYA:** (polar desert) Bol'shevik Is., Cape Baranov, 79°16'N, 101°40'E, alt. 20 m, 15.vii.1996, *M. Z. 96905* (LE 232966); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, 16.vii.1996, *M. Z. 96906* (LE 232856); same Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, 21.viii.1998, *N. Matveeva* (LE 233026). **YAKUTIYA:** Indigirka River, 65°48'N, 142°53'E, alt. 250 m, forested (*Larix*) Ca–rocks, 20.vii.1992, *M. Z. 92555* (LE 233236).

24. *Clypeococcum bisporum* Zhurb. sp. nov.

Mycobank #513012.

PLATE 1 (PAGE 115).

Fungus lichenicola in thallis lichenum generum *Cetrariae* et *Flavocetrariae* parasiticus. Similis *Clypeococci cetrariae* sed ab eo imprimis differt ascis 2-sporis et ascosporis longioribus.

TYPE: **RUSSIA. YAKUTIYA:** Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 40 m, tundra, on *Flavocetraria cucullata* (th.), 12.viii.1998, *M. Zhurbenko 9867* (LE 232768, holotype).

DESCRIPTION. – *Vegetative hyphae* well developed, immersed, olive brown, flexuose, 2–3 µm diam., often completely penetrating the host's lobes, but mostly developed in its cortex, where forming clypei above the fungal fruit bodies. *Pseudothecia* subglobose to broadly ovoid, ostiolate, 0.15–0.20 mm diam., black, immersed, discrete to confluent, arising singly or in small groups under common blackish brown (dark olive brown in section), glossy, raised, discrete to confluent clypei 50–100 µm tall and up to 0.5 mm across. *Pseudothecial wall* of textura intricata in cross section, 10–20 µm thick, confluent with clypeus, patchy olive brown, K+ deep olive, K/I+ blackish brown, I+ orange brown. *Hymenium* and *subhymenium*

hyaline, I–. *Pseudoparaphyses* persistent, hyaline, filiform, scarcely branched and rarely anastomosing, apically neither pigmented nor swollen, 1–2 µm diam., septate, composed of individual cells 10–15 µm long. *Periphyses* not observed. *Asci* bitunicate, subcylindrical with rounded apices, gradually tapering towards the base, with short foot, tholus up to 8 µm tall, I–, K/I–, internal apical beak often distinct, (60–)65–75(–80) × (6–)7–8 µm, l/b = (7.5–)8.2–11.0(–12.5) (n = 24), at the beginning with 8 spore initials, but constantly 2–spored when mature. *Ascospores* fusiform, 1–septate, with equal cells, not constricted and sometimes slightly swollen at the septum (this torus–like structure better seen in K), septum and walls appear conspicuously dark rimmed by the spore outline, first pale olivaceous buff then medium fulvous to olive brown, sometimes guttulate, finely verruculose, halo not seen, (17–)20–27(–35) × (4–)5–5.5(–6) µm, l/b = (3.0–)3.6–5.3(–7.8) (n = 114), uniseriate or sometimes slightly inclined and overlapping in an ascus. *Pycnidia* semi–immersed, black (brown in section), subglobose, 20–30 µm diam. *Conidia* bacilliform, simple, hyaline, ca. 5 × 1.5 µm.

Etymology. – The specific epithet refers to its 2–spored asci.

Matrix and Biology. – Grows on lobes of *Cetraria laevigata* and *Flavocetraria cucullata*, mainly on their bases, occasionally on central portions. Pathogenic, induces pale to dark brown, shiny patches on the lobes, up to 8 mm diam., often surrounded by blackish–brown, grey brown or blackish–wine red marginal rim.

distribution. – Known from arctic tundra and forest–tundra in the Lower Lena River region (Siberia, Russia) and NW Alaska (USA).

Observations. – The new species fits the generic concept of *Clypeococcum* D. Hawksw. (Hawksworth 1977, Ertz 2004), but differs from the other seven known species of the genus in having 2–spored (vs. 4–8–spored) mature asci and much longer ascospores (> 20 µm), which are not constricted or even slightly swollen at septa (Hawksworth 1977, 1980, 1982; Øvstedal & Hawksworth 1986; Grube & Hafellner, 1990; Hafellner 1994; Navarro–Rosinés et al. 1994). Its ascospores are also unusual for *Clypeococcum* in having equal cells, while the other species, except *C. placopsiiphilum*, have unequal cells. *Clypeococcum bisporum* readily differs from *C. cetrariae* Hafellner, occurring on the same host species, by its 2–spored, longer and narrower asci 65–76 × 7–8 µm vs. 40–60 × 10–13 µm, longer and narrower fusiform ascospores with equal cells (20–27 × 5–5.5 µm vs. 15–18 × 5.5–7 µm) that are more finely verruculose, less crowded ascomata and a probably weaker pathogenic effect.

Additional specimens examined. – **RUSSIA. Yakutiya:** lower Lena River, Tit–Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest–tundra, on *Flavocetraria cucullata* (th.), 20.viii.1998, *M. Z. 9855* (LE 232622, GZU). **U.S.A. Alaska:** Kotzebue, 66°53'N, 162°31'W, alt. 30 m, tundra, on *Cetraria laevigata* (lobe bases), 19.vii.2000, *M. Z. 00463* (LE 232729).

Specimen of the type species of the genus (*Clypeococcum cladonema* (Wedd.) D. Hawksw.) examined for comparison. – **KANARISHE INSELN:** on *Neofuscelia verruculifera* (th.), 23.ii.1994, *J. Hafellner 32889* (GZU 19–94).

25. *Clypeococcum placopsiiphilum* Øvstedal & D. Hawksw.

Notes. – Ascospores (15–)15.5–21(–25) × (7–)7.5–8.5(–9) µm (n = 18). Previously known only from maritime Antarctic and Iceland (Øvstedal & Hawksworth 1986, Berger 2000). New to the Arctic, Asia and Russia.

Specimen Examined. – **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 400 m, wet fellfield, on *Placopsis gelida* (th.), 20.vii.1995, *M. Z. 95399* (LE 233293).

26. *Cornutispora lichenicola* D. Hawksw. & B. Sutton

Note. – *Arctoparmelia* is a new host genus.

Specimens Examined. – **RUSSIA. Murmansk Region:** Umba, 66°44'N, 34°20'E, on boulder in burnt forest, on *Arctoparmelia centrifuga* (ap. – hymenium), 20.vii.1976, *A. Dombrovskaya* (LE 233299).

27. *Corticifraga peltigerae* (Fuckel) D. Hawksw. & R. Sant.

Specimens Examined. – **RUSSIA. Taimyr Pen.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, tundra, on *Solorina crocea* (upper lobe surface, in slightly damaged parts), 28.viii.1995, *M. Z. 95297* (LE 232836). **U.S.A. Alaska:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 150 m, *Picea sitchensis* dominated forest, on *Peltigera degenii* (th.), 1.ix.2000, *M. Z. 00427* (LE 233690).

28. *Dacampia hookeri* (Borrer) A. Massal.*

Specimens Examined. – **CANADA. Nunavut:** Victoria Is., 70°46'N, 109°09'W, alt. 150 m, tundra, on sandy soil, 8.viii. 1999, *N. Matveeva* (LE 232866:b); Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°36'W, tundra, on mossy soil, viii.1999, *N. Matveeva* (LE 233381:b). **RUSSIA. Severnaya Zemlya:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 20 m, polar desert, on loamy soil, 15.vii.1996, *M. Z. 96934* (LE 233164). **Taimyr Pen.** (all in tundra): N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 150–200 m, rocks, on mineral soil and moribund mosses, 22.vii.1995, *M. Z. 95288* (LE 232816); 6.viii.1995, *M. Z. 95287* (LE 232976); 27.viii.1995, *M. Z. 95289* (LE 233006); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, Ca–rocks, on mineral soil, 1.viii.1995, *M. Z. 9565* (LE 232986). **Wrangel' Is.:** Gusinaya River, 71°10'N, 179°10'E, tundra, on mossy soil, 16.vii.1979, *T. Polozova* (LE 233277:b). **Chukotka:** Gil'mymlineiveem River, 65°48'N, 173°15'E, stony tundra, on mossy soil, 26.vii.1977, *I. Makarova* (LE 232886); Iskaten' Range, 66°35'N, 179°10'W, tundra, on mossy soil, 26.vii.1971, *I. Makarova* (LE 232806:b); Inchoun, 66°15'N, 170°20'W, tundra, on sandy soil, 4.viii.1975, *I. Makarova* (LE 233151:b).

29. *Dactylospora* cf. *aeruginosa* Holien & Ihlen

Notes. – Pathogenicity not observed. The specimen differs from *Dactylospora aeruginosa* in black vs. brown apothecial discs, violet blue (K+ aeruginose) patches just dispersed in the hymenium, hypothecium and exciple, vs. violet blue exciple, ascospores without perispore, light to medium brown vs. hyaline to light brown, (0–)1(–2)–septate vs. 1–septate, (11–)12–14(–15) × (4–)5–7(–8) µm (n = 23) vs. (9–)11–14.5(–16) × (3–)3.5–5.5(–7) µm (Ihlen et al. 2004). *Dactylospora aeruginosa* was previously known only from coastal forests of Norway and S. Alaska, growing on various epiphytic lichens including one *Biatora* species – *B. efflorescens*.

Specimen Examined. – **RUSSIA. Chukotka:** Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, on *Biatora subduplex* (th.) growing on mosses, 9.vii.1979, *I. Makarova* (LE 233368).

30. *Dactylospora amygdalariae* Triebel

Note. – Pathogenicity not observed.

Specimens Examined. All specimens on *Amygdalaria* spp. (cephalodia, th., occasionally ap.). – **RUSSIA. Murmansk Region:** Khibiny Mts., Kukisvumchorr Mt., 67°40'N, 33°41'E, alt. 350 m, boulder field in *Betula* forest, on *A. panaeola*, 15.viii.1997, *M. Z. 97340* (LE 232841). **Northern Ural:** Yanypupuner Range, 62°05'N, 59°06'E, alt. 650 m, rocks in subalpine belt, on *A. panaeola*, 30.vii.1997, *M. Z. 97339* (LE 232941). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 400 m, fellfield, on *A. elegantior*, 20.vii.1995, *M. Z. 95341* (LE 233011); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, boulder field in tundra, on *A. elegantior*, 29.vii.1995, *M. Z. 95342* (LE 232961). **Putorana Plateau:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in sparse *Larix* forest, on *A. panaeola*, 18.viii.1983, *M. Z. 83204* (LE 207350). **Chukotka:** Vesnovannaya River, 65°20'N, 174°26'E, boulder field, on *A. subdissentiens*, 12.viii.1980, *I. Makarova* (LE 207039); Baran'e Lake, 66°54'N, 175°15'E, stony tundra, on *A. pelobotryon*, 22.vii.1980, *I. Makarova* (LE 207222); Penkignei Bay, 64°50'N, 173°10'W, stony tundra, on *A. panaeola*, 10.viii.1978, *A. Katenin* (LE 233061); Loren River, 65°40'N, 171°50'W, stony tundra, on *A. panaeola*, 16.viii.1972, *I. Makarova* (LE 207225:b, LE 207628:b); Enurmino, 66° 56'N, 171°49'W, stony tundra, on *A. panaeola*, 27.vii.1972, *I. Makarova* (LE 232801); Lavrentiya Bay, 65°35'N, 171°00'W, rocks, on *A. panaeola*, 16.vii.1972, *I. Makarova* (LE 207140:a); Puoten Bay, 65°50'N, 170°30'W, stony tundra, on *A. pelobotryon*, 23.vii.1972, *I. Makarova* (LE 232971); Inchoun, 66°15'N, 170°20'W, stony tundra, on *A. panaeola*, 4.viii.1975, *I. Makarova* (LE 207227:a).

31. *Dactylospora deminuta* (Th. Fr.) Triebel

Notes. – Infected parts of the hosts usually healthy–looking, rarely moribund. *Lecidea*, *Lepraria*, *Phaeorrhiza* and *Stereocaulon* are new host genera *Micarea incrassata* and *Psora rubiformis* are new host species.

Specimens Examined. – **RUSSIA. Murmansk Region:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, on *Biatora cuprea* (th.), 22.vii.1997, *M. Z. 97354:a* (LE 233323:a). **Yamal Pen.:** Neromayakha River, 70°10'N, 69°10'E, tundra, on *Biatora subduplex* (th.), 16.vii.1990, *O. Khitun* (LE 233263); on *Lopadium coralloideum* (th.), 17.vii.1990, *O. Khitun* (LE 233338). **Severnaya Zemlya:** (polar desert) Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 20–40 m, on *Phaeorrhiza sareptana* var. *sphaerocarpa* (th., ap.), 15.vii.1996, *M. Z. 96128* (LE 207635); on *Biatora cuprea* (th.), 17.vii.1996, *M. Z. 96937:b* (LE 233223:b); on *Psora rubiformis* (th.), 17.vii.1996, *M. Z. 96930* (LE 233922); on *Stereocaulon groenlandicum* (phyllocladia), 18.vii.1996, *M. Z. 96938* (LE 233373); on *Biatora cuprea* (th.), 18.vii.1996, *M. Z. 96940* (LE 233393); same Is., Studenaya River, 78°37'N, 101°05'E, alt. 130 m, on *Lopadium coralloideum* (th.), 17.viii.1997, *N. Matveeva* (LE 233258); same Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, on *Micarea incrassata* (th.), 31.vii.1997, *N. Matveeva* (LE 233317); 19.iii.1998, *N. Matveeva* (LE 233397); on *Micarea assimilata* (th.), 6.viii.1997, *N. Matveeva* (LE 233156:b); 25.viii.1998, *N. Matveeva* (LE 233306); on *Lopadium coralloideum* (th.), 14.viii.1997, *N. Matveeva* (LE 233218); 25.viii.1998, *N. Matveeva* (LE 233308); on *Lecidea epiphaea* (th.), 19.viii.1998, *N. Matveeva* (LE 233313); 1.ix.1998, *N. Matveeva* (LE 233384); on *Biatora subduplex* (th., occasionally ap.), 1.ix.1998, *N. Matveeva* (LE 233264). **Taimyr Pen.** (all in tundra): Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 350 m, on *Phaeorrhiza nimbosa* (th.), 18.viii.1995, *M. Z. 95401:b* (LE 233302:b); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 120–500 m, on *Bryonora castanea* (th., ap.), 10.viii.1995, *M. Z. 95381* (LE 233325); 20.viii.1995, *M. Z. 95380* (LE 233315); on *Lepraria* sp. (th.), 27.viii. 1995, *M. Z. 95357:a* (LE 233207:a); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, on *Biatora subduplex* (th.), 28.viii.1995, *M. Z. 95398* (LE 233303); Khatanga, 71°58'N, 102°27'E, sparse *Larix* forest, on *Mycobilimbia carneoalbida* (th.), 4.ix.1995, *M. Z. 95397* (LE 233163). **Wrangel' Is.:** Tundrovaya River, 71°30'N, 179°45'W, on *Lecidea epiphaea* (th.), 1996, *S. Kholod* (LE 233203). **Chukotka:** (all in tundra, unless otherwise indicated) Gil'mymlineiveem River, 65°48'N, 173°15'E, on *Biatora subduplex* (th.), 20.vii.1977, *I. Makarova* (LE 207623); on *Biatora cuprea* (th.), 23.vii.1977, *I. Makarova* (LE 207622); Bezymyannoe Lake, 66°39'N, 176°40'E, on *Lecidea epiphaea* (th.), 8.vii.1979, *I. Makarova* (LE 207619); on *Biatora cuprea* (th.), 9.vii.1979, *I. Makarova* (LE 233294); on *Lopadium pezizoideum* (th.), 9.vii.1979, *I. Makarova* (LE 233248); Pepenveem Creek, 65°55'N, 175°50'W, on *Biatora cuprea* (th.), 2.vii.1970, *I. Makarova* (LE 233233); Koluchin Bay N of Cape Anayan, 66°40'N, 173°54'W, on *Lopadium pezizoideum* (th.), 29.viii.1980, *A. Katenin* (LE 233358:a); Ioni Lake, 65°53'N, 173°44'W, on *Biatora cuprea* (th.), 30.vi.1977, *I. Makarova* (LE 207625); 5.vii.1977, *I. Makarova* (LE 207627); Provideniya, 64°25'N, 173°15'W, on *Biatora cuprea* (th.), 5.vii.1983, *I. Makarova* (LE 233314); Lorino, 65°29'N, 171°43'W, on *Biatora* cf. *subduplex* (th.), 7.vii.1972, *I. Makarova* (LE 207620); lower Chegitun' River, 66°30'N, 171°05'W, *Salix lanata* shrubs, on *Mycobilimbia tetramera* (th.), 15.viii.1982, *A. Katenin* (LE 207621:a); lower Kurupka River, 64°45'N, 174°05'W, alt. 200 m, on *Lopadium coralloideum* (th.), 15.viii.1987, *A. Katenin* (LE 233208). **SWEDEN. Torne lappmark:** Abisko, 68°24'N, 18°20'E, alt. 800 m, lower alpine belt, on *Mycobilimbia berengeriana* (th.), 25.viii.1992, *M. Z. 92490* (LE 233276). **U.S.A. Alaska:** Barrow, 71°19'N, 156°37' W, tundra, on *Lopadium coralloideum* (th.), 2.vii. 1999, *D. Walker* (LE 233228).

32. *Dactylospora glaucomarioides* (Tuck.) Hafellner

Specimens Examined. All specimens in tundra on *Megaspora verrucosa* (th., occasionally ap.). – **RUSSIA. Nenetz Region:** Malozemel'skaya Tundra, Seduiyakha River, 68°23'N, 53°15'E, 3.viii.1998, *O. Lavrinenko* (LE 233246). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 300 m, 24.vii.1995, *M. Z. 95374* (LE 233247); 22.viii.1995, *M. Z. 95373* (LE 233387). **Yakutiya:** Lena River delta, Amerika–Khaya hill, 72°35'N, 126°18'E, alt. 50 m, 30.vii.1998, *M. Z. 98299* (LE 233267).

33. *Dactylospora frigida* Hafellner

Notes. – Pathogenicity not observed. New to the Arctic, Asia and Russia.

Specimens Examined. All specimens in tundra on thalli of *Brigantiaea fuscolutea*. – **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 180–450 m, 10.viii.1995, *M. Z. 95377* (LE 233195); 20.viii.1995, *M. Z. 95378* (LE 233185); 26.viii.1995, *M. Z. 95375* (LE 233205). **Chukotka:** Iskaten' Range, 66°35'N, 179°10'W, 14.vii. 1971, *I. Makarova* (LE 233215).

34. *Dactylospora lobariella* (Nyl.) Hafellner

Note. – New to Alaska.

Specimen Examined. – **U.S.A. Alaska:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 150 m, *Picea sitchensis* dominated forest, on *Lobaria pulmonaria* (th.: upper side), 1.ix.2000, *M. Z. 00432:b* (LE 233540:b).

35. *Dactylospora parasitica* (Flörke) Zopf

NOTES. – Infected apothecia damaged. The species usually grows on *Ochrolechia* and *Pertusaria* however, it was once reported on *Caloplaca* (Zedda & Sipman 2001).

SPECIMEN EXAMINED. – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, tundra, on *Caloplaca ammiospila* (ap.), 30.vii.1995, *M. Z. 95325* (LE 233073).

36. *Dactylospora purpurascens* Triebel

NOTE. – Pathogenicity not observed.

SPECIMENS EXAMINED. – **RUSSIA. PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in sparse *Larix* forest, on *Amygdalaria panaeola* (th., cephalodia), 2.viii.1983, *M. Z. 83219* (LE 232821); 18.viii.1983, *M. Z. 83220* (LE 232811).

37. *Diploschistes diacapsis* (Ach.) Lumbsch*

NOTE. – New to Yakutiya.

SPECIMENS EXAMINED. – **RUSSIA. YAKUTIYA:** Indigirka River, Tyubelyakh, 65°19'N, 143°15'E, alt. 700 m, steppe–like vegetation among sparse *Larix* forest, on mineral soil, 16.vii.1992, *M. Z. 92554* (filed under *Rhizocarpon malenconianum*, LE 232835).

38. *Echinodiscus kozhevnikovii* Zhurb. sp. nov.

Mycobank #513013.

PLATE 2 (PAGE 116).

Fungus lichenicola in thallis lichenum generis *Cetrariae* parasiticus. Similis *Echinodisci lesdainii*, sed hymenio hyalini et ascosporis oblongis et longioribus differt.

TYPE: **RUSSIA. MURMANSK REGION:** Khibiny Mts., head of Kaskasnyunjok Creek, 5 km SE of Umbozerskii pass, 67°46'N, 33°49' W, alt. 600 m, lichen tundra with stones and soil spots, on *Cetraria islandica* (th.), 18.viii.2007, *M. Zhurbenko 0768* (LE 233420, holotype; TUR, isotype).

DESCRIPTION. – *Vegetative hyphae* not observed. *Apothecia* discoid, without distinct margin, slightly constricted at the base, broadly sessile, 50–100(–150) µm diam., ca. 50 µm tall; disc plane to slightly convex, translucent, medium to dark yellowish brown when dry, framed by usually numerous ascending or descending white opaque marginal hairs; often aggregated in compact groups of up to 50, sometimes confluent. *Epihymenium* indistinct. *Hymenium* hyaline, 40–55 µm tall, K–, I–, K/I. Distinct ectal *exciple* not observed; inner exciple (hypothecium) hyaline to pale yellow–orangish, of textura angularis or globulosa, 20–30 µm tall, K–, I–, K/I–, MLZ+ reddish, CR+ coral. *Marginal hairs* hyaline, somewhat flexuose, not branched, slightly tapering, with obtuse apices, 32–58 µm long, 1–2 µm wide above to 2.5–3(–4) µm below, aseptate, smooth, wall ca. 0.5 µm thick, with continuous lumen, without glassy or refractive portions, CR–, MLZ–, often encrusted with hyaline granules dissolving in K. *Paraphyses* similar to marginal hairs, hyaline, more or less cylindrical, apically not swollen, 1.5–2.5(–3) µm diam., scarcely septate, not or scarcely branched below, sometimes exceeding the asci. *Asci* clavate, with a distinct stalk, wall about 1 µm thick, not or occasionally slightly thicker at the apex, no apical apparatus seen, (34–)40–50(–60) × (7–)9–13(–14) µm, l/b = (3.1–)3.6–4.8(–6.1) (n = 53, in CR, water, MLZ or phloxin), apex and walls I–, MLZ–; content I+ orange, MLZ+ orange, CR+ brownish orange; 8–spored. *Ascospores* hyaline, narrowly oblong to rarely narrowly elliptic, with rounded apices, straight to rarely slightly bent, (8–)10–12(–13.5) × 2.5–3.5 µm, l/b = (2.6–)3.1–4.1(–5.0) (n = 100), aseptate, smooth, without halo, usually with a few big guttules, diagonally uni– to polyseriate in an ascus. Aggregations of bacilliform hyaline *conidia* 2–3.5 × 0.5–1 µm of unclear nature were occasionally observed in squash preparations.

ETYMOLOGY. – The species is named after my friend, the late Dr. Yurii Kozhevnikov, who was a devoted explorer of Arctic wildlife.

Matrix and Biology. – Grows on lower portions of *Cetraria islandica* and *C. laevigata* lobes, mostly on their underside, occasionally on cilia. Pathogenic as infections are typically associated with dark brown patches up to 2 mm across.

distribution. – Known from mountain and arctic tundras and possibly northern taiga biomes in N. Eurasia (Russia).

Observations. – This minute hairy helotialean fungus strongly resembles members of the Hyaloscyphaceae Nannf. emend. Raitv. (Raitviir 2004). However, it differs from true Hyaloscyphaceae in the absence of a distinct ectal exciple. The best position for the species seems to be within the previously monotypic lichenicolous genus *Echinodiscus* Etayo & Diederich (Helotiales Nannf., genera incertae sedis) (Etayo & Diederich 2000, Lumbsch & Huhndorf 2007). *Echinodiscus kozhevnikovii* differs from the other known species of the genus, *E. lesdainii* (Vouaux) Etayo & Diederich, by its yellowish brown vs. greyish to blackish apothecia, absence of a violet pigment in the exciple and hymenium, marginal hairs covered by granules instead of a gelatinous sheath, bigger asci, longer and oblong vs. elliptical ascospores and host (*Cetraria* vs. *Lecania*).

Additional specimens examined. – **RUSSIA. Bol'shezemel'skaya Tundra:** Khar'yaga, 67°11'N, 56°30'E, alt. 70 m, *Betula nana* tundra, on *Cetraria islandica* (th.), 25.vii.2007, *M. Z. 0773* (LE 233410). **Magadan Region:** Maksim Gor'kii gold mine, 62°35'N, 150°20'E, northern taiga (?), on *Cetraria laevigata* (th.), 4.ix.1949, *A. Fisher* (LE 233440).

39. *Echinothecium reticulatum* Zopf

Notes. – Most abundant on lobe bases, which are often moribund. When growing on younger parts of the host thallus, no pathogenicity was observed. The species has almost always been reported from *Parmelia* s. str. However, I found no difference between specimens on *Parmelia* s. str. and those on *Arctoparmelia*. *Arctoparmelia centrifuga* is a new host species.

Specimens Examined. – **CANADA. Northwest Territories:** Daring Lake, 64°52'N, 111°35'W, on boulder in shrub tundra, on *Arctoparmelia separata* (th.), 10.viii.1999, *N. Matveeva* (LE 232981). **RUSSIA. Murmansk Region:** Khibiny Mts., Kukisvumchor Mt., 67°40'N, 33°40'E, alt. 500 m, timberline, on *A. centrifuga* (th.), 13.vii.1997, *M. Z. 97341* (LE 233071); Umbozero Lake, 67°50'N, 43°25'E, alt. 170 m, on boulder in *Picea* forest, on *A. centrifuga* (th., ap.: hymenium), 3.viii.1973, *A. Dombrovskaya* (LE 233250). **Severnaya Zemlya:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, polar desert, on *A. separata* (th.), 16.vii.1996, *M. Z. 96919* (LE 233051); *M. Z. 96920* (LE 233399). **Taimyr Pen.:** (all in tundra) Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 160 m, on *Parmelia sulcata* (th.), 15.viii.1995, *M. Z. 95347* (LE 232921); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 100–300 m, on *A. separata* (th.), 21.vii.1995, *M. Z. 95343* (LE 232891); 6.viii.1995, *M. Z. 95346* (LE 232951); 24.viii.1995, *M. Z. 95349* (LE 233389); 27.viii.1995, *M. Z. 95345* (LE 233001); 30.viii.1995, *M. Z. 95348* (LE 233369); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 50–100 m, on *A. separata* (th.), 29.vii.1995, *M. Z. 95350* (LE 233329); 31.vii. 1995, *M. Z. 95352* (LE 233209); 28.viii.1995, *M. Z. 95344* (LE 232881). **Yakutiya:** Lena River delta, Cape Krest–Tumsa, 72°22'N, 126°42'E, alt. 50 m, tundra, on *P. omphalodes* (th.), 4.viii.1998, *M. Z. 98291* (LE 233379); Indigirka River, Predporozhnoe, 65°00'N, 143°00'E, alt. 900 m, boulder field in subalpine belt, on *A. separata* (th.), 24.vi.1976, *I. Makarova* (LE 233370, LE 233400); New Siberian Islands, Kotel'nyi Is., Balyktakh River, 75°15'N, 140°00'E, on *A. centrifuga* (th.), 20.viii.1965, *O. Egorov* (LE 233240). **Magadan Region:** Kolyma Upland, Labaznaya River, 62°30'N, 160°00'E, on boulder among *Pinus pumila*–dwarf shrub tundra, on *A. separata* (th.), 9.ix.1951, *Vikulova* (LE 233031). **Chukotka:** (all in tundra) Baranikha, 68°30'N, 168°16'E, on *A. separata* (th.), 20.vi.1967, *E. Zimarskaya & B. Yurtsev* (LE 233339); 5.vii.1967, *E. Zimarskaya & I. Makarova* (LE 233150); on *A. centrifuga* (th., occasionally hymenium of ap.), 20.vi.1971, *I. Makarova* (LE 233180); 1971, *A. Galanin* (LE 233199); Baran'e Lake, 66°54'N, 175°15'E, on *A. separata* (th.), 22.vii.1980, *I. Makarova* (LE 233259); Iskaten' Range, 66°35'N, 179°10'W, on *P. saxatilis* (th.), 31.vii.1971, *I. Makarova* (LE 233210); Pepenveem Creek, 65°55'N, 175°50'W, on *A. centrifuga* (th.), 10.vii.1970, *I. Makarova* (LE 233290:a); Sireniki, 64°24'N, 173°54'W, on *A. separata* (th.), 15.vii.1986, *A. Katenin* (LE 233200); Loren River, 65°40'N, 171°50'W, on *A. separata* (th.), 13.viii.1972, *I. Makarova* (LE 232931); 16.viii. 1972, *I. Makarova* (LE 233041); Lorino, 65°29'N, 171°43'W, on *A. separata* (th.), 7.vii.1972, *I. Makarova* (LE 233190); Lavrentiya Bay, 65°35'N, 171°00'W, boulder field, on *P. saxatilis* (th.), 21.vii.1973, *I. Makarova* (LE 233319); on *A. separata* (th.), 31.vii.1973, *I. Makarova* (LE 233160); Puoten Bay, 65°50'N, 170°30'W, on *A. centrifuga* (th.), 18.vii.1972, *I. Makarova* (LE 233169); Inchoun, 66°15'N, 170°20'W, on *A. centrifuga* (th.), 4.viii. 1975, *I. Makarova* (LE 233320).

40. *Endococcus rugulosus* Nyl.

NOTES. – Infected thallus bleached. *Amygdalaria elegantior* is a new host species.

SPECIMENS EXAMINED. – **RUSSIA. PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in sparse *Larix* forest, on *Amygdalaria elegantior* (th.), 18.viii.1983, *M. Z. 83218* (LE 232911). **CHUKOTKA:** Egvekinot, 66°20'N, 179°07'W, scree tundra, on *A. panaeola* (th.), 25.vi.1970, *I. Makarova* (LE 232901); Ioni Lake, 65°53'N, 173°44'W, stony tundra, on *A. panaeola* (th.), 3.vii.1977, *I. Makarova* (LE 232871).

41. *Epibryon conductrix* (Norman) Nik. Hoffm. & Hafellner

SPECIMENS EXAMINED. Both specimens in polar desert on *Catapyrenium* sp. (th.). – **RUSSIA. SEVERNAYA ZEMLYA:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 20 m, 17.vii.1996, *M. Z. 96928* (LE 233377); same Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, 16.viii.1997, *N. Matveeva* (LE 232825:a).

42. *Epicladonia sandstedei* (Zopf) D. Hawksw.

NOTE. – This frequently reported fungus is new to Mongolia and Asia.

SPECIMEN EXAMINED. – **MONGOLIA. KHANGAI UPLAND:** Arakhangai Aimak, Chulut Somon, 20 km S of Chulut, 47°15'N, 100°10'E, mountain *Larix* forest, on *Cladonia pyxidata* (basal squamules), 15.viii.1972, *L. Biazrov 1811* (LE 233640).

43. *Epilichen glauconigellus* (Nyl.) Hafellner*

NOTE. – Sometimes causes local discoloration.

SPECIMENS EXAMINED. All specimens on *Baeomyces rufus* (th.). – **RUSSIA. SEVERNAYA ZEMLYA:** Bol'shevik Is., Mikoyan Bay, 79°18'N, 101°55'E, alt. 10 m, polar desert, 21.vii.1996, *M. Z. 96933* (LE 233224). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, sparse *Larix* forest, 18.viii.1983, *M. Z. 83227* (LE 233395); Sobach'e Lake, 69°04'N, 91°32'E, alt. 900 m, mountain tundra, vii.1996, *N. Matveeva* (LE 233184). **YAKUTIYA:** Lena River delta, Kurungnaakh–Sise Is., 72°20'N, 126°18'E, alt. 40 m, tundra, 8.viii.1998, *M. Z. 98302* (LE 233194).

44. *Epilichen scabrosus* (Ach.) Clem.*

SPECIMENS EXAMINED. All specimens on *Baeomyces rufus* (th.), unless otherwise indicated. – **CANADA. NUNAVUT:** Ellesemere Is., Eureka, 80°05'N, 85°38'W, *Dryas* polygonal vegetation, 31.vii.1999, *N. Matveeva* (LE 233174). **NORWAY. SVALBARD:** North–East Land, Murchison fjord, Nord Bay, 80°02'N, 18°53'E, alt. 10 m, on *Baeomyces* sp. (th.), 19.viii.2007, *N. Matveeva* (LE 210310). **RUSSIA. SEVERNAYA ZEMLYA:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 40 m, polar desert, 18.vii.1996, *M. Z. 96694* (LE 210446) [previously erroneously reported as *Epilichen glauconigellus* (Zhurbenko, 2008a)]. **TAIMYR PEN.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 400 m, tundra, 20.vii.1995, *M. Z. 95383* (LE 233365); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 250 m, tundra, on *Baeomyces placophyllus* (th.), 28.vii.1995, *M. Z. 95382* (LE 233375). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, sparse *Larix* forest, 18.viii.1983, *M. Z. 83226* (LE 233355). **YAKUTIYA:** Lena River delta, Kurungnaakh–Sise Is., 72°20'N, 126°18'E, alt. 40 m, tundra, 8.viii.1998, *M. Z. 98303* (LE 233204).

45. *Everniicola flexispora* D. Hawksw.

NOTES. – Though not uncommon in temperate regions of the Holarctic, this fungus has rarely been reported from the Arctic. New to Asia.

SPECIMENS EXAMINED. All specimens on *Nephroma arcticum* (th.). – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, tundra, 22.viii.1997, *M. Z. 97333* (LE 232896); Tumannyi, 69°01'N, 35°48'E, alt. 200 m, shrub tundra, 19.viii.1997, *M. Z. 97334* (LE 232896). **TAIMYR PEN.:** Khatanga, 71°58'N, 102°27'E, sparse *Larix* forest, 4.ix.1995, *M. Z. 95292* (LE 232926). **CHUKOTKA:** Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, 5.vii.1979, *I. Makarova* (LE 233155).

46. *Gypsoplaca macrophylla* (Zahlbr.) Timdal f. *blastidiata* Zhurb. forma nova*
Mycobank #513014.

Plate 3 (Page 117).

Gypsoplacae macrophyllae f. *macrophyllae* similis sed areolis blastidiatis.

Type: **RUSSIA. Taimyr Pen.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 200 m, limestone rocks in tundra, on mineral soil, 9.viii.1995, *M. Zhurbenko 95404* (LE, holotype).

Notes. – This peculiar species was described in details in Timdal (1990). The new form differs from the previously described material in developing marginal blastidia 0.2–0.5 mm diam. In the examined blastidiate specimens apothecia were absent. Both forms occur in the same place, but no intermediates were observed. *Gypsoplaca macrophylla* is sporadically distributed in the Holarctic, being most frequent in the mountainous regions of Central Asia (Biazrov & Zhurbenko 2004). It is known in the Arctic from a few finds from Alaska (USA), Northwest Territories (Canada), Greenland and the abovementioned locality in Taimyr Peninsula (Russia).

Additional specimens examined. (all specimens in LE) – **KIRGIZSTAN. Tyan'–Shan':** Terskey–Alatau Range, 20 km S of Kochkorki, 42°00'N, 75°45'E, alt. 2000 m, on sandy soil, 16.viii.1971, *L. Bredkina* (f. *macrophylla*); 21.viii.1971, *L. Bredkina 1025* (f. *blastidiata*). **TADZHIKISTAN. Pamir**: Murgab Region, Chechekty River valley, 38°20'N, 74°00'E, alt. 3860 m, cold stony desert, on sandy soil in rocks, 22.vii.1965, *N. Golubkova 133* (f. *macrophylla*); 27 .vii. 1965, *N. Golubkova 408*, *N. Golubkova 426* (f. *blastidiata*); 17.vii.1966, *N. Golubkova 409* (f. *blastidiata*).

47. *Halecania alpivaga* (Th. Fr.) M. Mayrhofer*

Note. – Previously known in Russia only from Novaya Zemlya and arctic Yakutiya (Kotlov 2003).

Specimen Examined. – **RUSSIA. Chukotka:** Inchoun, 66°15'N, 170°20'W, tundra, on *Placynthium asperellum* (th.) growing on Ca–rock, 9.viii.1975, *I. Makarova* (LE 233352).

48. *Hypogymnia fistulosa* McCune & Krog*

Notes. – This recently described lichen was previously known only from Alaska (McCune 2008). New to Asia and Russia.

Specimen Examined. – **RUSSIA. Chukotka:** Lavrentiya Bay, 65°35'N, 171°00'W, stony tundra, on soil, 29.vii.1973, *I. Makarova* (filed under *Phaeosporobolus alpinus*, LE 233269:b).

49. *Intralichen christiansenii* (D. Hawksw.) D. Hawksw. & M.S. Cole

Notes. – Infected hymenia become blackish. *Protoblastenia rupestris* and *Candelariella arctica* are new host species.

Specimens Examined. – **RUSSIA. Yakutiya:** lower Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, stony tundra, on *Protoblastenia rupestris* (ap.: hymenium), 16.viii.1988, *I. Makarova* (LE 233372:b). **Chukotka:** Inchoun, 66°15'N, 170°20'W, coastal mountain, on *Candelariella arctica* (ap.: hymenium), 29.vii.1975, *I. Makarova* (LE 232873).

50. *Japewia tornoënsis* (Nyl.) Tønsberg*

Notes. – Sometimes causes local discoloration on the host. *Japewia tornoënsis* is a ubiquitous lichen growing on a wide range of substrates including ageing parts of the thallus of various lichens (Zhurbenko 2008b). It has not been reported on *Brodoa* and *Pseudephebe* before.

Specimens Examined. – **RUSSIA. Severnaya Zemlya:** Oktyabr'skoi Revolutsii Is., Goluboe Lake, 79°47'N, 97°34'E, polar desert, on *Melanelia commixta* (th.), 6.viii.1985, *M. Gavrilo* (LE 233342); Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 40 m, polar desert, on *Brodoa oroarctica* (lobe bases), 18.vii.1996, *M. Z. 96931* (LE 233235). **Troinoi Is. in Kara Sea:** 75°57'N, 82°56'E, boulder field in tundra, on *Parmelia omphalodes* ssp. *glacialis* (th.), 10.vii. 1992, *Yu. Kozhevnikov* (LE 233382). **Chukotka:** Lavrentiya Bay, 65°35'N, 171°00'W, scree tundra, on *Pseudephebe minuscula* (th.), 18.vii.1973, *I. Makarova* (LE 233312).

51. *Lecanographa rinodinae* (Vězda) R. Sant.

NOTES. – Partly associated with dark patches on the host thallus. New to the Arctic, Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Enmyvaam River, 68°15'N, 166°03'E, tundra, on *Phaeorrhiza nimbosa* (th.: mainly along areole margins), 8.vii.1980, *I. Makarova* (LE 233262).

52. *Lecanora dispersa* (Pers.) Sommerf. f. *parasitans* (Wedd.) Harm.*

NOTES. – This lichenicolous form of *Lecanora dispersa* has been reported on *Dermatocarpon miniatum* by Poelt (1974). It is new to the Arctic, Russia and possibly Asia. Differences from *Lecanora thallophila* H. Magn., a similar obligately lichenicolous species restricted to *Dermatocarpon* are depicted by Ryan et al. (2004).

SPECIMEN EXAMINED. – **RUSSIA. Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 250 m, rocky canyon, on *Dermatocarpon miniatum* var. *complicatum* (th.), 17.viii.1995, *M. Z. 95290* (LE 232996).

53. *Lecanora luteovernalis* Brodo*

NOTES. – The species was described from the American Arctic and is known also from Greenland and Svalbard (Brodo 1981, Elvebakk & Tønsberg 1992). New to Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, limestone hill, on soil in tundra, 1.viii.1995, *M. Z. 95394* (filed under *Merismatium nigritellum*, LE 233383 and *Phaeosporobolus alpinus* LE 233243).

54. *Lettauia cladoniicola* D. Hawksw. & R. Sant.

NOTE. – New to Alaska.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Alaska Range, Denali National Park, headwaters of Hinnes Creek, 63°43'N, 149°07'W, alt. 900 m, shrub mountain tundra, on *Cladonia stygia* (th.), 30.viii.2000, *M. Z. 00264* (LE 233460, herb. Diederich).

55. *Libertiella curvispora* D. Hawksw. & Miądl.

NOTES. – New to Alaska. *Peltigera collina* is a new host species.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 30 m, *Populus trichocarpa* forest, on *Peltigera collina* (th.), 1.ix.2000, *M. Z. 00292:b* (LE 233500:b).

56. *Lichenochora constrictella* (Müll. Arg.) Hafellner

SPECIMENS EXAMINED. Both specimens on *Fulgensia bracteata* (th.). – **RUSSIA. YAKUTIYA:** lower Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, rocks in tundra, 19.viii.1998, *M. Z. 98287* (LE 233022). **CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, tundra, 17.vii.1973, *I. Makarova* (LE 232872).

57. *Lichenochora mediterraneae* Calat., Nav.–Ros. & E. Calvo

NOTES. – Induces gall–like swellings of the host thallus. Ascospores (2–)4–septate, (38–)43–56(–60) × 6–8(–9) µm (n = 14). New to the Arctic, Asia and Russia. *Fuscopannaria praetermissa* is a new host species.

SPECIMENS EXAMINED. – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 250 m, tundra, on *Fuscopannaria praetermissa* (th.), 28.vii.1995, *M. Z. 95400:a* (LE 233292:a).

58. *Lichenoconium lecanorae* (Jaap) D. Hawksw.

NOTES. – Causes strong discoloration of the host apothecia and thallus. *Arthophacopsis*, *Asahinea* and *Bryocaulon* are new host genera. *Caloplaca cerina*, *Lecanora luteovernalis* and *Melanelia stygia* are new host species.

Specimens Examined. – **CANADA. Nunavut:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°36'W, *Dryas* vegetation, on *Lecanora luteovernalis* (ap.), 1.viii.1999, *N. Matveeva* (LE 233333). **RUSSIA. Murmansk Region:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10–100 m, on boulder in tundra, on *Allantoparmelia alpicola* (ap.: hymenium), 21.viii.1997, *M. Z. 97353* (LE 233225); 22.viii.1997, *M. Z. 97352* (LE 233255). **Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 200 m, on *Caloplaca cerina* var. *chloroleuca* (ap.: hymenium), 15.viii.1995, *M. Z. 95324* (LE 233053); NW coast of Pyasino Lake, 70°00'N, 87°30'E, alt. 80 m, stony tundra, on *Melanelia stygia* (ap.), 1.viii. 1983, *M. Z. 8356* (LE 233219). **Putorana Plateau:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, *Larix–Betula* forest, on *Melanohalea septentrionalis* (ap.: hymenium), 1.viii.1983, *M. Z. 83222* (LE 233280). **Yakutiya:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 80 m, tundra, on *Bryocaulon divergens* (th.), 24.viii.1998, *M. Z. 98301* (LE 233285); Indigirka River, 65°42'N, 142°39'E, alt. 300 m, forested (*Larix*) rocks, on *Bryodina rhypariza* (ap.: hymenium), 19.vii. 1992, *M. Z. 92210* (LE 233305). **Chukotka:** Baran'e Lake, 66°54'N, 175°15'E, tundra, on *Asahinea chrysantha* (lobe base), 22.vii.1980, *I. Makarova* (LE 233153:a); Lunnaya River at 115 km of the road Egvekinot–Iul'tin, 67°05'N, 178°47'W, on *Asahinea chrysantha* (th.), 7.viii.1970, *I. Makarova* (LE 233081); Pepenveem Creek, 65°55'N, 175°50'W, stony tundra, on *Arctoparmelia centrifuga* (ap.: hymenium), 10.vii.1970, *I. Makarova* (LE 233290:b); Ioni Lake, 65°53'N, 173°44'W, tundra, on *Melanohalea septentrionalis* (ap.: hymenium), 7.vii.1977, *I. Makarova* (LE 233349); Enurmino, 66°56'N, 171°49'W, tundra, on *Allantoparmelia alpicola* (ap.: hymenium), 5.viii.1972, *I. Makarova* (LE 233245); Lavrentiya Bay, 65°35'N, 171°00'W, boulder field, on *Arthophacopsis parmeliarum* growing on *Parmelia saxatilis*, 29.vii.1973, *I. Makarova* (LE 233360:b).

59. *Lichenoconium usneae* (Anzi) D. Hawksw.

Note. – Clearly pathogenic.

Specimens Examined. – **RUSSIA. Murmansk Region:** Ponoi, 67°05'N, 41°08'E, on boulder in *Salix* shrubs, on *Melanelia hepatizon* (ap.: hymenium), 12.viii.1968, *A. Dombrovskaya* (LE 233149). **Nenetz Region:** Bol'shezemel'skaya Tundra, Ortin River, 67°59'N, 54°03'E, forest–tundra, on *Parmelia sulcata* (th.), 30.vi.1999, *O. Lavrinenko* (LE 233230). **Chukotka:** Baranikha, 68°30'N, 168°16'E, stony tundra, on *P. omphalodes* (ap.), 20.vi.1971, *I. Makarova* (LE 233300).

60. *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw.

Notes. – This is the second report from Russia. *Caloplaca borealis* is a new host species.

Specimen Examined. – **RUSSIA. Nenetz Region:** Pechora River delta, 68°03'N, 53°33'E, *Salix* shrubs, on *Caloplaca borealis* (ap.: hymenium) growing on bark, 13.viii.1998, *O. Lavrinenko* (LE 233033).

61. *Lichenopeltella peltigericola* (D. Hawksw.) R. Sant.

Notes. – Commensalistic. New to Asia.

Specimens Examined. – **RUSSIA. Putorana Plateau:** Kulyumbe River, 67°58'N, 89°40'E, *Larix* forest, on *Peltigera scabrosa* (th.), 6.viii.2008, *Z. Yanchenko* (LE 232899). **U.S.A. Alaska:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 150 m, *Picea sitchensis* dominated forest, on *Peltigera degenii* (th.: mostly on veins of the underside, occasionally on the upper side), 1.ix.2000, *M. Z. 00428* (LE 233510).

62. *Lichenopeltella santessonii* (P.M. Kirk & Spooner) R. Sant.

Notes. – Grows on moribund lobes of the host. New to Alaska.

Specimens Examined. – **U.S.A. Alaska:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 30–150 m, *Picea sitchensis* dominated forest, on *Peltigera degenii* (th.: mostly on veins and rhizines of the underside, occasionally on upper side), 1.ix.2000, *M. Z. 00275* (LE 233490), *M. Z. 00263* (LE 233700).

63. *Lichenopuccinia poeltii* D. Hawksw. & Hafellner

Note. – New to Asia and Russia.

Specimen Examined. – **RUSSIA. Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 160 m, tundra, on *Parmelia sulcata* (th.), 15.viii.1995, *M. Z. 95354* (LE 233350).

64. *Lichenosticta alcicorniaria* (Linds.) D. Hawksw.

NOTE. – This frequently reported fungus is new to Mongolia and Asia.

SPECIMENS EXAMINED. All specimens on *Cladonia pyxidata* (underside of basal or occasionally podetial squamules). – **MONGOLIA. KHANGAI UPLAND:** Arakhangai Aimak, Tevshrulekh Somon, between Tsetserleg–Gol and Khukh–Sumein–Gol Rivers, 47°15'N, 101°50'E, slope of Mt. "2507", *Larix* forest, 7.ix.1979, *L. Biazrov 3433* (LE 233680); same Aimak, Tsenkher Somon, between Khukh–Sumein–Gol and Tsetserleg–Gol Rivers, 47°12'N, 101°52'E, Ikh–Ar–Ul Mt., alt. 2447 m, mountain meadow, 19.vi.1971, *L. Biazrov 2693* (LE 233670); Bulgan Aimak, Dashinchilen Somon, Tsetserleg–Ula Mt., 47°30'N, 103°40'E, *Ulmus* forest in a canyon, 29.vi.1972, *L. Biazrov 1847* (LE 233560).

65. *Lichenostigma rugosum* G. Thor

NOTES. – Diederich (1986) reported that *Lichenostigma rugosum* can be lichenized, when growing on the discs of host apothecia. Based on my observations the fungus avoids healthy hymenia (being very abundant on adjacent thalli and thalline margins of apothecia), but occasionally colonizes a destroyed hymenium and thalline warts occurring among a healthy hymenium. I did not observe the fungus forming its own lichenized thallus. New to Mongolia.

SPECIMENS EXAMINED. All specimens on *Diploschistes scruposus* (th., rarely ap.), unless otherwise indicated. – **MONGOLIA. KHANGAI UPLAND:** Central Aimak, Undzhul Somon, 6 km E of mine, 46°52'N, 106°03'E, alt. 1300 m, on plant remnants in rocks, on *D. muscorum*, 2.vii.1972, *L. Biazrov 3128* (LE 232885). **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, 22.viii.1997, *M. Z. 97336* (LE 232905); Khibiny Mts., Vud'yavrchorr Mt., 67°40'N, 33°32'E, alt. 700 m, boulder field, 26.vii.1961, *A. Dombrovskaya* (LE 232855); 26vi.1965, *T. Piin* (LE 232935); Tuloma River, Padun, 68°35'N, 31°50'E, 16.vii.1968, *A. Dombrovskaya* (LE 232865); Lavnatundra Mt., 68°28', 30°00'E, on boulder in *Betula–Picea* forest, 26.vii.1987, *T. Dudoreva* (LE 232845). **CHUKOTKA:** Enmyvaam River, 68°15'N, 166°03'E, stony tundra, 8.vii.1980, *I. Makarova* (LE 232955).

66. *Lichenostigma semiimmersum* Hafellner

NOTE. – New to Russia.

SPECIMENS EXAMINED. All specimens on *Buellia elegans* (th.). – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, tundra on limestone hill, 1.viii.1995, *M. Z. 95390* (LE 233344). **YAKUTIYA:** Lena River between Sinsk and Tit–Ary, 61°04'N, 127°29'E, alt. 150 m, Ca–rocks with steppe–like vegetation, 4.vii.1992, *M. Z. 92392* (LE 233354); Indigirka River, 65°48'N, 142°53'E, alt. 250 m, forested (*Larix*) Ca–rocks, 20.vii.1992, *M. Z. 9283* (LE 233324).

67. *Merismatium coccisporum* (Norman) Vouaux

SPECIMENS EXAMINED. – **RUSSIA. PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in sparse *Larix* forest, on *Amygdalaria panaeola* (th.), 18.viii.1983, *M. Z. 83221* (LE 232831). **CHUKOTKA:** Loren River, 65°40'N, 171°50'W, scree tundra, on *A. elegantior* (th.), 16.viii.1972, *I. Makarova* (LE 207628:a); Inchoun, 66°15'N, 170°20'W, stony tundra, on *A. panaeola* (th.), 4.viii.1975, *I. Makarova* (LE 207227:b); Lavrentiya Bay, 65°35'N, 171°00'W, Ca–rocks, on *A. panaeola* (th.), 16.vii.1972, *I. Makarova* (LE 207140:b).

68. *Merismatium decolorans* (Arnold) Triebel

NOTES. – Commensalistic. *Lecidoma* is a new host genus.

SPECIMEN EXAMINED. – **RUSSIA. Yakutiya:** Lena River delta, Amerika–Khaya hill, 72°35'N, 126°18'E, alt. 50 m, tundra, on *Lecidoma demissum* (th.), 30.vii.1998, *M. Z. 98312* (LE 233322).

69. *Merismatium heterophractum* (Nyl.) Vouaux

NOTES. – *Buellia* is a new host genus, *Lopadium pezizoideum* a new host species. Infected tissues are sometimes slightly discolored.

Specimens Examined. – **RUSSIA. Severnaya Zemlya**: Bol'shevik Is., Cape Baranov, 79°16'N, 101°40'E, alt. 20 m, polar desert, on *Buellia insignis* (ap., occasionally th.), 20.vii.1996, *M. Z. 96681* (LE 233450) **Taimyr Pen.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 50–250 m, tundra, on *Lopadium pezizoideum* (th.), 28.vii.1995, *M. Z. 95355* (LE 233198); on *Buellia epigaea* (th.), 31.vii.1995, *M. Z. 95389* (LE 233394:b). **Chukotka:** Palyavaam River, 68°45'N, 173°49'E, on *Cladonia pocillum* (moribund parts of primary squamules), 1980, *B. Yurtsev* (LE 233660); Televeem River, 65°50'N, 175°05'E, tundra, on *Lepraria* sp. (th.), 19.vii.1979, *I. Makarova* (LE 233286); Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, on *Biatora subduplex* (ap.), 8.vii.1979, *I. Makarova* (LE 207626); Sireniki, 64°24'N, 173°54'W, tundra, on *Biatora subduplex* (th.), 20.vii.1983, *I. Makarova* (LE 233283); on *Buellia insignis* (th.), 22.vii.1983, *I. Makarova* (LE 233374); lower Chegitun' River, 66°30'N, 171°05'W, *Salix lanata* shrubs, on *Biatora subduplex* (th., ap.), 15.viii.1982, *A. Katenin* (LE 207621:b).

70. *Merismatium nigritellum* (Nyl.) Vouaux

Notes. – Ascospores (13–)16.5–25(–31) × (6.5–)8.5–12.5(–16) μm (n = 64), their size and septation significantly vary in different specimens. The fungus often grows on the marginal or ageing parts of the host thallus but also on the prothallus or indefinite film between several lichens. *Brigantiaea*, *Bryonora*, *Fuscopannaria*, *Gyalecta*, *Lecanora*, *Lecidea*, *Lepraria*, *Polyblastia* and *Polychidium* are new host genera. *Biatora cuprea*, *B. subduplex*, *Lopadium coralloideum*, *Micarea assimilata* and *Mycobilimbia carneoalbida* are new host species.

Specimens Examined. – **RUSSIA. Murmansk Region:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, on *Biatora cuprea* (prothallus film), 22.viii.1997, *M. Z. 97354:c* (LE 233323:c). **Severnaya Zemlya:** (polar desert) Bol'shevik Is., Cape Baranov, 79°16'N, 101°40'E, alt. 20 m, on *Biatora subduplex* (th., occasionally ap.), 13.vii.1996, *M. Z. 96936* (LE 233284); same Is., Ostantsovaya River, 79°13'N, 102°02'E, alt. 60 m, on *Lepraria neglecta* group (th.), 12.vii.1996, *M. Z. 96925* (LE 233386); same Is., Mikoyan Bay, 79°18'N, 101°55'E, alt. 10 m, on *Polyblastia terrestris* (th.), 21.vii.1996, *M. Z. 96943* (LE 233181); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, on *Megaspora verrucosa* (th.), 16.vii.1996, *M. Z. 96929* (LE 233347); same Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, on *Micarea assimilata* (th.), 6.viii.1997, *N. Matveeva* (LE 233316); on *Micarea* sp. (th.), 27.viii.1998, *N. Matveeva* (LE 233297); on *Lecidea epiphaea* Nyl. (th.), 1.ix.1998, *N. Matveeva* (LE 233274). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 50–180 m, tundra, on *Megaspora verrucosa* (th. and prothallus), 6.viii.1995, *M. Z. 95372* (LE 233186); on *Mycobilimbia carneoalbida* (prothallus), 25.viii.1995, *M. Z. 95393* (LE 233334); on *Brigantiaea fuscolutea* (th.), 26.viii.1995, *M. Z. 95376* (LE 233175); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150–250 m, tundra, on *Fuscopannaria praetermissa* (th.), 28.vii.1995, *M. Z. 95400:c* (LE 233292:c); on limestone hill, on *Lecanora luteovernalis* (th.), 1.viii.1995, *M. Z. 95394* (LE 233383); on *Megaspora verrucosa* (th.), 9.viii.1995, *M. Z. 95371* (LE 233166). **Putorana Plateau:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in sparse *Larix–Betula* forest, on *Polychidium muscicola* (th.), 2.viii.1982, *A. Titov* (LE 233353); on *Lopadium coralloideum* (th.), 2.viii.1983, *M. Z. 83224* (LE 233328). **Wrangel' Is.:** Krasnyi Flag River, 71°30'N, 178°55'W, alt. 100 m, tundra, on *Megaspora verrucosa* (prothallus), 27.vii.1997, *S. Kholod* (LE 233367). **Chukotka:** Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, on *Bryonora castanea* (th.), 14.vii.1979, *I. Makarova* (LE 207629); Koluchin Bay N of Cape Anayan, 66°40'N, 173°54'W, tundra, on *Lopadium pezizoideum* (th.), 29.viii.1980, *A. Katenin* (LE 233358:b); Inchoun, 66°15'N, 170°20'W, tundra, on *Gyalecta foveolaris* (th.), 2.viii.1975, *I. Makarova* (LE 233376).

71. *Miriquidica garovaglii* (Schaer.) Hertel & Rambold*

Note. – New to Central Siberian Arctic (Andreev et al. 1996).

Specimen Examined. – **RUSSIA. Severnaya Zemlya:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, ephemeral water tract, on stone, 16.vii.1996, *M. Z. 96942* (filed under *Muellerella ventosicola*, LE 233391).

72. *Monodictys cellulosa* S. Hughes

Note. – New to Russia.

Specimen Examined. – **RUSSIA. Karelia:** Kondopoga Region, Kivach waterfall, 62°17'N, 33°59'E, on *Arthonia vinosa* (th.) on *Populus tremula*, 2.vii.1998, *J.–O. Hermansson* (LE 233430).

73. *Monodictys fuliginosa* Etayo

NOTE. – New to North America.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 150 m, *Picea sitchensis* dominated forest, on *Lobaria pulmonaria* (th.: upper side), 1.ix.2000, *M. Z. 00432:a* (LE 233540:a).

74. *Muellerella erratica* (A. Massal.) Hafellner & V. John

NOTES. – The ascospores of the specimen on *Protoblastenia* are narrower than usual (5–)6–7.5(–8) × (2–)2.5–3(–3.5) µm (n = 38) vs. (5.5–)6–8(–8.5) × (2.5–)3–4.5(–5) µm (Triebel 1989). *Caloplaca ammiospila* is a new host species.

SPECIMENS EXAMINED. – **RUSSIA. TAIMYR PEN.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 150 m, tundra, on *Caloplaca ammiospila* (ap.: hymenium), 6.viii.1995, *M. Z. 95326* (LE 233062); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 250 m, on *Caloplaca* sp. (ap.: hymenium) growing on Ca–rock, 9.viii.1995, *M. Z. 95327* (LE 232892). **YAKUTIYA:** lower Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, stony tundra, on *Protoblastenia rupestris* (th.), 16.viii.1988, *I. Makarova* (LE 233372:a). **CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, Ca–rocks in tundra, on *P. incrustans* (th.), 12.vii.1973, *I. Makarova* (LE 233252).

75. *Muellerella lichenicola* (Sommerf.) D. Hawksw.

NOTES. – Pathogenicity not observed. *Mycoblastus* is a new host genus *Caloplaca epiphyta* and *C. nivalis* are new host species.

SPECIMENS EXAMINED. – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, on *Caloplaca nivalis* (th.), 22.viii.1997, *M. Z. 97337* (LE 232842). **TAIMYR PEN.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 120–250 m, tundra, on *C. epiphyta* (th.), 22.vii.1995, *M. Z. 95333* (LE 232802); 20.viii.1995, *M. Z. 95336* (LE 232832); 27.viii.1995, *M. Z. 95335* (LE 232942); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, tundra on limestone hill, on *Fulgensia bracteata* (th.), 1.viii.1995, *M. Z. 95338* (LE 232952); alt. 250 m, tundra, on *C. epiphyta* (th.), 9.viii.1995, *M. Z. 95334* (LE 232992). **CHUKOTKA:** Gil'mymlineiveem River, 65°48'N, 173°15'E, tundra, on *C. epiphyta* (th.), 19.vii.1977, *I. Makarova* (LE 232852); on *Ochrolechia* sp. growing above moribund *Sticta arctica*, 23.vii.1977, *I. Makarova* (LE 233227:b); Vesnovannaya River, 65°20'N, 174°26'E, *Pinus pumila* shrubs, on *Mycoblastus sanguinarius* (th.) on naked lignum, 12.viii.1980, *I. Makarova* (LE 233378).

76. *Muellerella ventosicola* (Mudd) D. Hawksw.

NOTES. – Pathogenicity not observed. Exposed parts of perithecia characteristically wrinkled. *Miriquidica* is a new host genus.

SPECIMENS EXAMINED. – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 100 m, boulders in tundra, on *Ophioparma ventosa* var. *ventosa* (th.), 2.ix.1997, *M. Z. 97338* (LE 233032). **SEVERNAYA ZEMLYA:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 60 m, ephemeral water tract, on *Miriquidica garovaglii* (th.), 16.vii.1996, *M. Z. 96942* (LE 233391). **YAKUTIYA:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 100 m, stony tundra, on *O. ventosa* var. *lapponica* (th.), 10.vii.1988, *I. Makarova* (LE 232822). **CHUKOTKA:** Amguema River, 67°41'N, 178°35'W, boulder field in tundra, on *O. ventosa* var. *lapponica* (th.), 17.viii.1979, *I. Makarova* (LE 233012).

77. *Nectriopsis lecanodes* (Ces.) Diederich & Schroers

NOTE. – New to Alaska.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 30 m, *Populus trichocarpa* forest, on *Peltigera collina* (th.: mainly upper side, occasionally ap.), 1.ix.2000, *M. Z. 00426* (LE 233520).

78. *Phacopsis fusca* (Triebel & Rambold) Diederich

SPECIMEN EXAMINED. – **RUSSIA. YAKUTIYA:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 50 m, scree tundra, on *Xanthoparmelia stenophylla* (th.), 17.vii.1998, *M. Z. 98294* (LE 233359).

79. *Phacopsis huuskonenii* Räsänen

NOTES. – New to the Arctic, the first verified report for Russia. *Bryoria nitidula* is a new host species.

SPECIMENS EXAMINED. – **RUSSIA. YAKUTIYA:** Yana Upland, Bala, 67°10'N, 132°50'E, alt. 400 m, *Larix* forest, on *Bryoria lanestris* (th.), 1964, *V. Perfi'eva* (LE 233265). **CHUKOTKA:** Televeem River, 65°50'N, 175°05'E, tundra, on *B. nitidula* (th.), 18.vii.1979, *I. Makarova* (LE 233275).

80. *Phacopsis oxyspora* (Tul.) Triebel & Rambold

NOTE. – Induces galls, otherwise pathogenicity not seen.

SPECIMENS EXAMINED. – **RUSSIA. MURMANSK REGION:** Tumannyi, 69°01'N, 35°48'E, alt. 150 m, sparse *Betula* forest, on *Melanohalea septentrionalis* (th.), 19.viii.1997, *M. Z. 97343:b* (LE 233260:b). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, *Larix–Betula* forest, on *M. septentrionalis* (th.), 1.viii.1983, *M. Z. 83223* (LE 233189). **CHUKOTKA:** Yanrakynnot, 64°53'N, 172°30'W, stony tundra, on *Parmelia omphalodes* (th.), 22.viii.1978, *N. Sekretareva* (LE 233148); Lavrentiya Bay, 65°35'N, 171°00'W, stony tundra, on *P. saxatilis* (th.), 28.vii.1973, *I. Makarova* (LE 233380); 29.vii.1973, *I. Makarova* (LE 233340).

81. *Phaeopyxis punctum* (A. Massal.) Rambold, Triebel & Coppins

NOTE. – New to Alaska.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kobuk Valley Wilderness, 67°07'N, 159°03'W, alt. 40 m, northern taiga forest, on *Cladonia* sp. (basal squamules), 9.viii.2000, *M. Z. 00454* (LE 233630).

82. *Phaeosporobolus alpinus* R. Sant., Alstrup & D. Hawksw.

NOTES. – Mostly associated with discolored, damaged parts of the host thallus and apothecia. *Hypogymnia* and *Platismatia* are new host genera. *Buellia geophila*, *Lecanora epibryon* and *Melanohalea septentrionalis* are new host species.

SPECIMENS EXAMINED. – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 100 m, tundra, on *Platismatia glauca* (th.: mostly on marginal isidia) growing on soil, 21.viii.1997, *M. Z. 97357* (LE 233343). **NENETZ REGION:** Malozemel'skaya Tundra, Nenetz Ridge, 68°21'N, 53°08'E, on boulder in shrub tundra, on *Parmelia sulcata* (th.: naked medulla), 19.viii.1998, *O. Lavrinenko* (LE 233279). **TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–150 m, tundra, on *Buellia geophila* (th.), 29.vii.1995, *M. Z. 95388* (LE 233364); on *Lecanora luteovernalis* (th., ap.), 1.viii.1995, *M. Z. 95395* (LE 233243); NW coast of Pyasino Lake, 70°00'N, 87°30'E, alt. 80 m, *Alnus fruticosa–Betula nana* tundra, on *Melanohalea septentrionalis* (th., occasionally ap.), 18.vii.1983, *M. Z.* 83130 (LE 233330). **YAKUTIYA:** Indigirka River, 65°48'N, 142°53'E, alt. 250 m, forested (*Larix*) Ca–rocks, on neighbouring *Megaspora verrucosa* and *Lecanora epibryon* (th., ap.), 20.vii.1992, *M. Z. 92556* (LE 233336). **CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, boulder field in tundra, on *Hypogymnia fistulosa* (th.: naked medulla), 29.vii.1973, *I. Makarova* (LE 233269:b).

83. *Phoma caloplacae* D. Hawksw.

NOTES. – Pathogenic. Previously known in Asia only from the type locality in Central Siberia (Hawksworth 1981). *Bryonora* is a new host genus.

SPECIMENS EXAMINED. – **RUSSIA. CHUKOTKA:** Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, on *Bryonora castanea* (ap.: hymenium), 11.vii.1979, *I. Makarova* (LE 233396:b); on *Caloplaca cerina* (ap.: hymenium) growing on bone, 14.vii.1979, *I. Makarova* (LE 233092); Sireniki, 64°24'N, 173°54'W, tundra, on *C. cerina* var. *chloroleuca* (ap.: hymenium), 17.vii.1983, *I. Makarova* (LE 233063).

84. *Phoma cytospora* (Vouaux) D. Hawksw.

NOTES. – Causes bleaching. New to Asia. *Melanelia disjuncta* is a new host species.

SPECIMEN EXAMINED. – **RUSSIA. TAIMYR PEN.:** Krasnaya River, 74°35'N, 98°28'E, alt. 160 m, on *Melanelia disjuncta* (th.), 12.viii.1995, *M. Z. 95353* (LE 233220).

85. *Plectocarpon linitae* (R. Sant.) Wedin & Hafellner

NOTE. – Sometimes causes slight discoloration.

SPECIMENS EXAMINED. All specimens on *Lobaria linita* (upper side of lobes, usually at their bases). – **RUSSIA. MURMANSK REGION:** Ponoi, 67°05'N, 41°08'E, forest–tundra, 11.viii.1968, *A. Dombrovskaya* (LE 233304). **NENETZ REGION:** Bol'shezemel'skaya Tundra, Bol'shaya Talata River, 69°05'N, 61°05'E, tundra, 9 IX 2008, *O. Lavrinenko* (LE 233027). **YAKUTIYA:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 80 m, tundra, 24.viii.1998, *M. Z. 98276* (LE 233095). **CHUKOTKA:** Uelen, 66°20'N, 169°55'W, tundra, 8.viii.1975, *I. Makarova* (LE 233390).

86. *Polycoccum bryonthae* (Arnold) Vězda

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Iskaten' Range, 66°35'N, 179°10'W, tundra, on *Caloplaca jungermanniae* (ap. – hymenium), 20.vii.1971, *I. Makarova* (LE 232983).

87. *Polycoccum ventosicola* Zhurb.

NOTES. – Previously known only from the type locality in Norway (Zhurbenko 2007). New to Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Vesnovannaya River, 65°20'N, 174°26'E, scree tundra, on *Ophioparma ventosa* var. *lapponica* (th., ap. margin), 15.viii.1980, *I. Makarova* (LE 232912).

88. *Protoblastenia incrustans* (DC.) J. Steiner

NOTE. – Previously known in the Russian Arctic only from Novaya Zemlya (Andreev et al. 1996).

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, on Ca–rocks in tundra, 12.vii.1973, *I. Makarova* (filed under *Muellerella erratica*, LE 233252).

89. *Psora nipponica* (Zahlbr.) Gotth. Schneid. *

NOTE. – New to Russia.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** 12 km NE of Novoe Chaplino, 64°34'N, 172°40'W, alt. 150 m, small rocks on mountain slope among dwarf shrub–moss–lichen tundra, on soil in rock crevices, 28.viii.2001, *M. Z. 01637* (herb. Zhurbenko; rev. E. Timdal).

90. *Pyrenidium actinellum* Nyl.

NOTES. – Causes local discoloration of the host thallus.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Bezymyannoe Lake, 66°39'N, 176°40'E, tundra, on *Baeomyces rufus* (th.), 7.vii.1979, *I. Makarova* (LE 233154).

91. *Refractohilum peltigerae* (Keissl.) D. Hawksw.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 150 m, *Picea sitchensis* dominated forest, on *Peltigera degenii* (th.), 1.ix.2000, *M. Z. 00258* (LE 233480).

92. *Rhagadostoma lichenicola* (De Not) Keissl.

NOTE. – Often on ageing parts of the host thallus.

SPECIMENS EXAMINED. All specimens on *Solorina crocea* (th., including undersides of lobes near their margins). – **RUSSIA. NENETZ REGION:** Bol'shezemel'skaya Tundra, Cape Bolvanskii Nos, 68°15'N, 54°27'E, tundra, 24.vii.1999, *O. Lavrinenko* (LE 233017). **SEVERNAYA ZEMLYA:** Bol'shevik Is., Cape Baranov, 79°16'N, 101°40'E, alt. 20 m, polar desert, 10.vii.1996, *M. Z. 96893:b* (LE 232937:b); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 10–450 m, polar desert, 16.vii.1996, *M. Z. 96892* (LE 232977); 17.vii.1996, *M. Z. 96891* (LE 232959). **TAIMYR PEN.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 400 m, tundra, 20.vii.1995, *M. Z. 95283:b* (LE 233007:b). **YAKUTIYA:** Indigirka River, Ust'–Nera, 64°30'N, 143°10'E, alt. 700 m, boulder field in sparse *Larix* forest, 11.vii.1992, *M. Z. 92551* (LE 232947).

93. *Rhizocarpon malenconianum* (Llimona & Werner) Hafellner & H. Mayrhofer

NOTES. – Infected parts of thallus become yellowish. New to Russia.

SPECIMEN EXAMINED. – **RUSSIA. YAKUTIYA:** Indigirka River, Tyubelyakh, 65°19'N, 143°15'E, alt. 700 m, steppe–like vegetation among sparse *Larix* forest, on *Diploschistes diacapsis* (th.), 16.vii.1992, *M. Z. 92554* (LE 232835).

94. *Rhymbocarpus neglectus* (Vain.) Diederich & Etayo

NOTE. – Apothecia up to 0.4 mm diam.

SPECIMENS EXAMINED. All specimens in tundra on thalli of unidentified species of *Lepraria*, unless otherwise indicated. – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field, on *Lepraria neglecta* group, 22.viii.1997, *M. Z. 97347* (LE 233298); same coast, mouth of Olenka River, 69°02'N, 36°24'E, alt. 50 m, 5.ix.1997, *M. Z. 97349* (LE 233238). **POLAR URAL:** Sob' River, 66°59'N, 65°45'E, alt. 300 m, boulder field in subalpine belt, on *L. neglecta* group, 17.vii.1986, *M. Z. 86183* (LE 233188). **TAIMYR PEN.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 120–300 m, 24.vii.1995, *M. Z. 95361* (LE 233176); 25.vii.1995, M. Z. 95358:a (LE 233257:a); 27.viii.1995, *M. Z. 95357:b* (LE 233207:b); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–250 m, 28.vii.1995, *M. Z. 95365* (LE 233346); 29.vii.1995, *M. Z. 95360* (LE 233177); 30.vii.1995, *M. Z. 95356* (LE 233217); 28.viii.1995, *M. Z. 95366* (LE 233256). **PUTORANA PLATEAU:** Kapchuk Lake, 69°28'N, 91°02'E, alt. 200 m, boulder field in *Larix–Betula* forest, 2.viii.1983, *M. Z. 83225* (LE 233288). **CHUKOTKA:** Gil'mymlineiveem River, 65°48'N, 173°15'E, 19.vii.1977, *I. Makarova* (LE 233266).

95. *Roselliniella cladoniae* (Anzi) Matzer & Hafellner

SPECIMEN EXAMINED. – **MONGOLIA. KHANGAI UPLAND:** Arakhangai Aimak, Tevshrulekh Somon, 22 km NE of Tevshrulekh, top of Mt. "1610", 47°25'N, 102°10'E, mountain steppe, on *Cladonia pocillum,* 27.vi.1980, *L. Biazrov 4097* (LE 233610).

96. *Roselliniopsis gelidaria* (Mudd) Matzer

NOTES. – Infected tissues of the thallus are slightly discolored. New to Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Lunnaya River at 115 km of the road Egvekinot–Iul'tin, 67°05'N, 178°47'W, tundra, on *Placopsis gelida* (th.), 7.viii.1970, *I. Makarova* (LE 233273).

97. *Roselliniopsis ventosa* (Rostr.) Alstrup

NOTES. – Infected tissues slightly darkening. Perithecia almost completely immersed, 250–300 µm diam. Ascospores brown, simple, subglobose to broadly elliptic, (11–)11.5–13.5(–14) × (9–)10–11.5(–12) µm (n = 20, in K). New to Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. WRANGEL' IS.:** Klark River, 71°08'N, 178°16'W, tundra, on *Placopsis gelida* (cephalodia), viii.1986, *A. Dobrysh* (LE 233213).

98. *Scoliciosporum intrusum* (Th. Fr.) Hafellner*

NOTE. – New to Asia.

SPECIMENS EXAMINED. Both specimens grew in intimate connection with *Amygdalaria panaeola.* – **RUSSIA. CHUKOTKA:** Loren River, 65°40'N, 171°50'W, scree tundra, 16.viii.1972, *I. Makarova* (LE 207225:a, confirm. D. Triebel, 1997); Inchoun, 66°15'N, 170°20'W, stony tundra, 4.viii.1975, *I. Makarova* (LE 207227:c).

99. *Sclerococcum gelidarum* Etayo & F. Berger

NOTES. – Infected tissues discolored. Previously known only from Iceland (Berger 2000). New to the Arctic, Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. CHUKOTKA:** Lavrentiya Bay, 65°35'N, 171°00'W, pebble bank of a stream, on *Placopsis gelida* (th., cephalodia), 1.viii.1973, *I. Makarova* (LE 233392).

100. *Scutula epiblastematica* (Wallr.) Rehm

NOTE. – *Peltigera collina* is a new host species.

SPECIMEN EXAMINED. – **USA. Alaska:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°30'W, alt. 30 m, *Populus trichocarpa* forest, on *Peltigera collina* (th.), 1.ix.2000, *M. Z. 00292:a* (LE 233500:a).

101. *Sphaerellothecium araneosum* (Arnold) Zopf var. *cladoniae* Alstrup & Zhurb.

SPECIMENS EXAMINED. All specimens on basal squamules of *Cladonia*. – **CANADA. NUNAVUT:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°36'W, tundra, on *C. pocillum*, 1.viii.1999, *N. Matveeva* (M); Victoria Is., Cambridge Bay, 69°12'N, 104°47'W, tundra, on *C. pocillum*, 24.vii.1999, *W. Gould* (LE 233429). **MONGOLIA. KHANGAI UPLAND:** Arakhangai Aimak, Tevshrulekh Somon, between Khukh–Sumein–Gol and Tsetserleg–Gol Rivers, Khairkhan Mt., 47°15'N, 101°50'E, alt. 2500 m, mountain meadow, on *C. pyxidata* (basal squamules), 13.vii.1973, *L. Biazrov 2769* (M). **NORWAY. SVALBARD:** Nordenskiöld Land, Grønfjorden, Barentsburg, 78°04'N, 14°13'E, alt. 100 m, fellfield with tundra, on *C. subcervicornis*, 14.vii.2003, *M. Z. 03239* (LE 233590); Bünsow Land, Billefjorden, Norddammen Lake, 78°38'N, 16°44'E, alt. 10 m, tundra, on *C. pocillum*, 21.vii.2003, *M. Z. 03198* (LE 233650); North–East Land, Murchison fjord, Nord Bay, 80°02'N, 18°53'E, alt. 10 m, on *C. pocillum*, 19.viii.2007, *N. Matveeva* (LE 210486). **U.S.A. ALASKA:** North Slope, Franklin Bluffs, 69°40'N, 148°43'W, alt. 130 m, tundra, on *C. pocillum*, 17.viii.2000, *D. Walker* (LE 233550); North Slope, Sagwon, 69°26'N, 148°42'W, alt. 100 m, tundra, on *C. pocillum*, 22.viii.2000, *D. Walker* (LE 233419); North Slope, Atigun Canyon, 68°27'N, 149°21'W, alt. 900 m, tundra, on *C. pocillum*, 31.vii. 2001, *M. Z. 01308* (LE 233570); Kobuk Valley Wilderness, 67°06'N, 159°01'W, alt. 50 m, northern taiga forest, on *C. symphycarpia* (psoromic acid strain), 4.viii.2000, *M. Z. 00451* (LE 233580); 8.viii.2000, *M. Z. 00452* (LE 233600).

102. *Sphaerellothecium contextum* Triebel

NOTE. – Infected apothecia become discolored.

SPECIMENS EXAMINED. All specimens on *Protoparmelia badia* (ap.: hymenium). – **RUSSIA. YAKUTIYA:** lower Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 200 m, rocks among tundra, 19.viii.1998, *M. Z. 98313* (LE 233212); Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 20 m, shale outcrops, 19.vii.1998, *M. Z. 98300* (LE 233165). **CHUKOTKA:** Amguema River, 67°41'N, 178°35'W, scree tundra, 6.viii.1979, *I. Makarova* (LE 207335); 17.viii.1979, *I. Makarova* (LE 233332).

103. *Sphaerellothecium minutum* Hafellner

NOTE. – New to Mongolia.

SPECIMENS EXAMINED. – **MONGOLIA. KHANGAI UPLAND:** Khan–Khukhein Range, Dulga–Ula Mt., 49°27'N, 94°42'E, alt. 2928 m, fellfield with *Kobresia*, on *Sphaerophorus fragilis* (th.), 9.vii.1976, *L. Biazrov 7597* (LE 232713). **NORWAY. SVALBARD:** North–East Land, Murchison fjord, Nord Bay, 80°02'N, 18°49'E, alt. 100 m, on *Sphaerophorus fragilis* (th.), 17.viii.2007, *N. Matveeva* (LE 210338).

104. *Sphaerellothecium parmeliae* Diederich & Etayo

NOTES. – Causes conspicuous blackish patches on the host thalli. Ascospores (9–)9.5–12.5(–15) × (2.5–)3–4(–5) µm (n = 37). New to the Arctic.

SPECIMENS EXAMINED. All specimens on *Parmelia omphalodes* (th.). – **RUSSIA. MURMANSK REGION:** Barents Sea coast, Shel'pino Bay, 69°05'N, 36°12'E, alt. 10 m, coastal cliffs among tundra, 4.ix.1997, *M. Z. 97344* (LE 233170); same coast, mouth of Olenka River, 69°02'N, 36°24'E, alt. 50 m, stony tundra, 5.ix.1997, *M. Z. 97345* (LE 233310). **TAIMYR PEN.:** Bikada River, 74°50'N, 106°30'E, vii.1989, *E. Pospelova* (LE 233398).

105. *Sphaerellothecium phaeorrhizae* Diederich & Zhurb.

NOTES. – Sometimes associated with slightly discolored parts of the host thalli. New to the Arctic. *Phaeorrhiza nimbosa* is a new host species.

SPECIMENS EXAMINED. All specimens on *Phaeorrhiza sareptana* var. *sphaerocarpa* (th.), unless otherwise indicated. – **RUSSIA. YAKUTIYA:** lower stream of Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, rocks among tundra, on *Phaeorrhiza nimbosa* (th., ap.), 19.viii.1998, *M. Z. 98311* (LE 233242); Indigirka River, 65°48'N, 142°53'E,

alt. 250 m, forested (*Larix*) Ca–rocks, 20.vii.1992, *M. Z. 92118* (LE 233182); same river, 65°51'N, 143°01'E, alt. 250 m, limestones with steppe–like vegetation among *Larix* forest, 20.vii.1992, *M. Z. 92119* (LE 233222); junction of Indigirka and In'yali Rivers, 65°10'N, 143°10'E, alt. 450 m, steppe–like vegetation among *Larix* forest, 17.vi.1976, *I. Makarova* (LE 233202:b). **Chukotka:** Enmyvaam River, 68°15'N, 166°03'E, tundra, 30.vi.1980, *I. Makarova* (LE 233192); 4.vii.1980, *I. Makarova* (LE 233172).

106. *Spirographa fusisporella* (Nyl.) Zahlbr.

Notes. – Infected hymenium completely destroyed. New to Russia. *Melanohalea septentrionalis* is a new host species.

Specimen Examined. – **RUSSIA. Murmansk Region:** Tumannyi, 69°01'N, 35°48'E, alt. 150 m, sparse *Betula* forest, on *Melanohalea septentrionalis* (ap.: hymenium), 19.viii.1997, *M. Z. 97342* (LE 233249).

107. "*Stigmidium" aggregatum* (Mudd) D. Hawksw.

Notes. – Induces gall–like verrucae on the host thallus. New to Russia.

Specimen Examined. – **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 300 m, sandstone rocks, on *Pertusaria lactea* (th.), 22.viii.1995, *M. Z. 95282* (LE 233037).

108. *Stigmidium cerinae* Cl. Roux & Triebel

Note. – Destroys infected hymenia.

Specimens Examined. All specimens on *Caloplaca cerina* var. *chloroleuca* (ap.: hymenium). – **RUSSIA. Murmansk Region:** 25 km SW of Alakurtti, Pyukhyakuru canyon, 66°47'N, 30°00'E, alt. 400 m, taiga forest, 5.viii.1986, *T. Dudoreva* (LE 232862). **Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 250 m, tundra, 17.viii.1995, *M. Z. 95331* (LE 232812); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 180–300 m, tundra, 24.vii.1995, *M. Z. 95332* (LE 233002); 20.viii.1995, *M. Z. 95328* (LE 233082); 26.viii.1995, *M. Z. 95330* (LE 233052); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 250 m, tundra, 9.viii.1995, *M. Z. 95329* (LE 233072). **Yakutiya:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 100 m, tundra, 24.viii.1998, *M. Z. 98286* (LE 232902).

109. *Stigmidium conspurcans* (Th. Fr.) Triebel & R. Sant.

Note. – Perithecia often abundant, but actual damage to the host not observed.

Specimens Examined. All specimens in rocks among tundra on *Psora rubiformis* (th.). – **RUSSIA. Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 300 m, 16.viii.1995, *M. Z. 95299* (LE 232995); 17.viii.1995, *M. Z. 95298* (LE 233025); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 150–250 m, 25.vii.1995, *M. Z. 95304* (LE 232965); 6.viii.1995, *M. Z. 95301* (LE 233075); 26.viii.1995, *M. Z. 95305* (LE 232895); 27.viii.1995, M. Z. 95300 (LE 233055); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100–250 m, 28 .viii.1995, *M. Z. 95294:b* (LE 232946:b); 29.vii.1995, *M. Z. 95302* (LE 232875); 30.vii.1995, *M. Z. 95295:b* (LE 232936:b); 28.viii.1995, *M. Z. 95405* (LE 233035). **Yakutiya:** Laptev Sea coast, Tiksi, 71°37'N, 128°51'E, alt. 100 m, 24.viii.1998, *M. Z. 98277* (LE 232985). **Chukotka:** Televeem River, 65°50'N, 175°05'E, 23 vii.1979, *I. Makarova* (LE 233045); Iskaten' Range, 66°35'N, 179°10'W, 7.vii.1971, *I. Makarova* (LE 232975); Amguema River, 67°41'N, 178°35'W, 6.viii.1979, *I. Makarova* (LE 233005); 15.viii.1979, *I. Makarova* (LE 233085); Novoe Chaplino, 64°34'N, 172°40'W, alt. 150 m, 28.viii.2001, *M. Z. 01152* (LE 233345).

110. *Stigmidium croceae* (Arnold) Cl. Roux & Triebel

Notes. – Infected tissues become discolored and dark. New to Asia and Russia.

Specimen Examined. – **RUSSIA. Severnaya Zemlya:** Bol'shevik Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 450 m, polar desert, on *Solorina crocea* (upper side of lobes), 16.vii.1996, *M. Z. 96894* (LE 232917).

111. *Stigmidium hafellneri* Zhurb. sp. nov.
Mycobank #513015.

Plate 4 (Page 118).

Fungus lichenicola in thallis lichenum generis *Flavocetrariae* parasiticus. Similis *Stigmidii microcarpi* sed ab eo imprimis ascosporis coloratis differt.

Type: **RUSSIA. Yakutiya:** lower Lena River, Tit–Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest–tundra, on lobes of *Flavocetraria cucullata*, 20.viii.1998, *M. Zhurbenko 9854* (LE 232546, holotype, GZU, isotype).

Description. – *Vegetative hyphae* not observed. *Ascomata* perithecioid, subglobose, ostiolate, (30–)50 µm diam., black, shiny, ¼ to occasionally ½ protruding, separated or sometimes adjacent to confluent; aggregated in groups of up to 150 on infection patches. *Peridium* in surface view of textura angularis or textura epidermoidea, of cells 5–13 × 3–6 µm, in cross section of 2–3 cells, about 10 µm thick, brown, K+ grey olive, BCr+ blue–green. *Interascal* and *ostiolar filaments* not observed. *Interascal gel* I–, K/I–, BCr+ pale violet. *Asci* bitunicate, lanceolate to narrowly lanceolate with rounded apices, occasionally narrowly ovate, narrowly elliptic or narrowly oblong, with no or short foot, tholus up to 5 µm tall, sometimes with distinct internal apical beak, (23–)26–36(–40) × (6–)7–9(–12) µm, l/b = (2.3–)3.0–4.8(–6.2) (n = 66, in water, I, K/I or BCr), 8–spored; wall I–, K/I–, BCr–, ascoplast I+ yellow to brownish orange, K/I+ brownish orange, BCr+ blue (only in immature asci). *Ascospores* broadly soleiform with broader upper cell, straight, 1–septate or very rarely simple, markedly constricted at the septum, at first colorless, then soon pale to mostly medium olive brown, wall smooth or rarely granulate (seen only in pale ascospores), rarely with indistinct halo ca. 1 µm thick, usually guttulate but non–pseudotetrablastic, (7–)7.5–8.5(–11) × (2.5–)3–3.5(–4.5) µm, l/b = (1.8–)2.2–2.7(–3.2) (n=147, in water, I, K/I or BCr), biseriate, partly overlapping and inclined in an ascus; colored mature ascospores BCr–, sporoplast of hyaline immature ascospores BCr+ blue. *Conidiomata* not observed.

Etymology. – The species is named after Dr. Josef Hafellner in recognition of his important contribution to the knowledge of lichenicolous fungi.

Matrix and Biology. – Grows on lobes of *Flavocetraria cucullata*, usually at their bases. Pathogenic, infection patches 2–4(–6) mm across, becoming grey and finally occasionally perforated, often with a dark (grey–)brown, slightly elevated marginal rim.

Distribution. – Known from mountain tundra, northern forest tundra and possibly northern taiga biomes in northern and central Asia (Russia).

Observations. – The new species is provisionally placed in *Stigmidium* s.l. and further broadens the circumscription of this evidently heterogenous genus. Ascospores that are constantly colored at maturity have not been known among *Stigmidium* species. However, colored post–mature ascospores occur in about 1/3 of the species of the genus and can even be typical in species as *Stigmidium leprariae* Zhurb. or *S. placynthii* Cl. Roux & Nav.–Ros. Usually coloration of *Stigmidium* ascospores is pale, but it can also be dark, e.g. in *S. gyrophorarum* (Arnold) D. Hawksw.

Stigmidium microcarpum Alstrup & J.C. David is the only other species of the genus known to grow on cetrarioid lichens. It differs from *S. hafellneri* in the broader asci, and permanently hyaline and longer ascospores (see description below). Both *Stigmidium* species occurred on *Flavocetraria cucullata* in the same localities. By its colored ascospores the new species resembles species of *Clypeococcum, Endococcus*, and *Polycoccum*. However, *Clypeococcum* can be distinguished by its ascomata united by a common dark clypeus and persistent pseudoparaphyses, *Endococcus* by persistent ostiolar filaments and asci with a hemiamyloid periascal gel, and *Polycoccum* by persistent interascal filaments (Calatayud 2004, Ertz 2004, Kainz & Triebel 2004).

Additional specimens examined. (all specimens on lobes of *Flavocetraria cucullata*). **RUSSIA. Buryatiya:** E. Sayan Mts., Oka Lake, 51°55'N, 100°40'E, alt. 2000 m, *Larix* forest tundra, 15.vi.2005, *M. Z. 05168* (LE 233088). **Magadan Region:** Maksim Gor'kii gold mine, 62°35'N, 150°20'E, northern taiga (?), 9.ix.1949, *A. Fisher* (LE 233078).

112. *Stigmidium leprariae* Zhurb.

Notes. – Previously known only from the type locality in Norway (Zhurbenko 2007). New to Russia.

Specimen Examined. – **RUSSIA. Murmansk Region:** Barents Sea coast, Dal'nie Zelentsy, 69°07'N, 36°05'E, alt. 10 m, boulder field in tundra, on *Lepraria neglecta* group (th.), 22.viii.1997, *M. Z. 97346* (LE 233348).

113. *Stigmidium microcarpum* Alstrup & J. C. David

Description. – *Vegetative hyphae* immersed, olive–brown, flexuose, 3–5 µm diam., with smooth wall, not always distinct. *Ascomata* perithecioid, subglobose, with ostiole up to 10 µm diam., 30–50(–80) µm diam., 1/8 to ½ protruding, black, shiny, separated or occasionally adjacent to confluent, often aggregated in groups of up to 200 on infection patches. *Peridium* in surface view of textura angularis, of cells 4–12 × 4–8 µm, olive–brown, K+ olive, BCr+ blue. *Interascal* and *ostiolar filaments* not observed. *Interascal gel* I–, K/I–. *Asci* bitunicate, (narrowly) elliptic to lanceolate, occasionally ovate, sometimes inflated below or in the middle, apex rounded, foot short or absent, tholus up to 5 µm tall, sometimes with distinct internal apical beak, (22–)26–36(–45) × (4–)9–13(–15) µm, l/b = (1.7–)1.9–4.3(–7.5) (n = 99, in water, I, K/I or BCr), 8–spored; wall and tholus I–, K/I–, BCr–, ascoplast I+ orange red, K/I+ brown red, BCr+ blue. *Ascospores* soleiform with rounded ends and wider upper cell or rarely fusiform with somewhat attenuated ends and almost equal cells, 1–septate or rarely simple, constricted at the septum, permanently hyaline, wall smooth, occasionally with indistinct halo up to 1 µm thick, usually guttulate but non–pseudotetrablastic, (6–)8.5–11.5(–13) × (2–)3–3.5(–4.5) µm, l/b = (2.0–)2.5–3.5(–4.3) (n=181, in water, I, K/I or BCr), biseriate, partly overlapping and inclined in an ascus; sporoplast BCr+ blue. *Conidiomata* not observed.

Matrix and Biology. – This species grows on both sides of lobes (often on their central and upper portions and along the margins), and rarely on apothecia, of *Flavocetraria cucullata*, *Vulpicida juniperinus*, *V. pinastri* and *V. tilesii*. It usually produces conspicuous grey or brown, finally sometimes perforated infection patches up to 7 mm across, frequently surrounded by a dark marginal rim. When growing on *Vulpicida* the ascomata are often dispersed and the pathogenic effect less conspicuous. Sometimes locally very abundant.

Discussion. – *Stigmidium microcarpum* was described from two collections on *Flavocetraria cucullata* from Greenland and Denmark (Alstrup 1993). There are some discrepancies between our material and the protologue of the species, where its ascomata were reported as being 35–50 µm in diam., asci much smaller (15–20 × 5 µm) and staining I+ blue when young, ascospores smaller (7–9 × 2–3 µm), composed of two more or less equal cells with somewhat attenuated ends, not constricted at the septum. I have never observed asci that small, or their distinct I+ blue reaction. Size of the ascospores varied significantly, for instance, LE 233098 has ascospores (6–)6.5–8(–9) × (2–)2.5–3 µm (n = 25). The shape of the ascospores depicted in the protologue also occurred in the specimens examined, but is not typical.

New to Mongolia and North America. *Vulpicida juniperinus* and *V. pinastri* are new host species.

Specimens Examined. – **MONGOLIA. Khangai Upland:** Dzabkhan Aimak, Ikh–Ula Somon, Tarbagatai Range, Solongoit Pass, alt. 2450 m, sparse coniferous forest, on *Vulpicida juniperinus* (th.), 1.vii.1976, *L. Biazrov 7040* (LE 233018); same Aimak, Otgon Somon, Otgon–Tenger Mt., alt. 3300 m, on *V. tilesii* (th.), 13.vii.1976, *L. Biazrov 7064* (LE 233038); Arakhangai Aimak, Tevshrulekh Somon, between Tsetserleg–Gol and Khukh–Sumein–Gol Rivers, alt. 2507 m, on *F. cucullata* (th.), 13.vii.1973, *L. Biazrov 642* (LE 232948). **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 200–300 m, tundra, on *V. tilesii* (th.), 20.vii.1995, *M. Z. 95278* (LE 233028), 20.viii.1995, *M. Z. 95280* (LE 232938), 22.viii.1995, *M. Z. 95279* (LE 233008). **Yakutiya:** lower Lena River, Tit–Ary Is., 71°58'N, 126°18'E, alt. 30 m, *Larix* forest–tundra, on *Flavocetraria cucullata* (th.), 20.viii.1998, *M. Z. 9857* (LE 232918, GZU); lower Lena River, Kharaulakh Range opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, tundra, on *V. tilesii* (th.), 19.viii.1998, *M. Z. 9863* (LE 232928); Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 80 m, tundra, on *F. cucullata* (th., ap.), 12.viii.1998, *M. Z. 9866* (LE 233058). **Chukotka:** Vesnovannaya River, 65°20'N, 174°26'E, *Pinus pumila* vegetation, on *V. juniperinus* (th.), 11.viii.1980, *I. Makarova* (LE 232988). **Buryatiya:** E. Sayan Mts., Oka Lake, 51°55'N, 100°40'E, alt. 2000 m, shrub tundra, on *F. cucullata* (th.), 15 VI 2005, *M. Z. 05286* (LE 233098). **Chita Region:** Sokhondo Reserve, Nar'ya Lake, alt. 1750 m, sparse coniferous forest, on *V. pinastri* (th.), 1987, *A. Nikol'skii* (LE 232958). **Sakhalin Is.:** Smirnykhovskii District, Central Range, *Pinus pumila* vegetation, on *V. juniperinus* (th.), 2004, *S. Chabanenko* (LE 232978). **U.S.A. Alaska:** Kobuk Valley Wilderness, 67°07'N, 159°03'W, alt. 50 m, sparse *Picea glauca* forest, on *F. cucullata* (th.), 12.viii.2000, *M. Z. 00137* (LE 233068).

114. *Stigmidium mycobilimbiae* Cl. Roux, Triebel & Etayo

Notes. – Ascospores only sometimes pseudotetrablastic, (11–)12.5–16(–17.5) × (3–)3.5–5(–6) µm (n = 48), asci (25–)35–55(–60) × (11–)13–17(–20) µm (n = 25). In the protologue ascospores are given as narrower (10.5–)11.5–16(–16.5) × (2.5–)3–4(–4.5) µm, and asci smaller 29–38 × 10–15 µm (Roux & Triebel 1994). New to the Arctic, Asia, Russia and Alaska.

Specimens Examined. All specimens on *Mycobilimbia lobulata* (th.). – **RUSSIA. Severnaya Zemlya:** Bol'shevik Is., Mikoyan Bay, 79°18'N, 101°55'E, alt. 10 m, polar desert, 21.vii.1996, *M. Z. 96130* (LE 207717); same Is., Akhmatov Bay, 79°04'N, 102°45'E, alt. 20 m, polar desert, 17.vii.1996, *M. Z. 96927* (LE 233296). **Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 300 m, tundra, 24.vii.1995, *M. Z. 95370* (LE 233357); S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, tundra on limestone hill, 1.viii.1995, *M. Z. 95369* (LE 233326). **U.S.A. Alaska**: Barter Is. near Beaufort Sea coast, 70°08'N, 143°38'W, alt. 10 m, tundra, 10.viii.1994, *D. Walker* (LE 207570).

115. *Stigmidium schaereri* (A. Massal.) Trevis.

Notes. – Infected thalli occasionally become greyish. Ascospores of *Stigmidium schaereri* are reported to be colorless (Roux & Triebel 1994), but in LE 233272 they are pale grey, (12–)13–16(–18) × 4–5.5 µm (n = 15).

Specimens Examined. All specimens in tundra on *Dacampia hookeri* (th.). – **CANADA. Nunavut:** Axel Heiberg Is., Bunde Fjord, 80°30'N, 94°36'W, 1.viii.1999, *N. Matveeva* (LE 233381:a); Victoria Is., 70°46'N, 109°09'W, alt. 150 m, 8.viii.1999, *N. Matveeva* (LE 232866:a). **RUSSIA. Taimyr Pen.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 150 m, limestones, 1.viii.1995, *M. Z. 95286* (LE 233036). **Yakutiya:** lower Lena River, opposite Tit–Ary Is., 71°59'N, 126°19'E, alt. 150 m, rocks, 19.viii.1998, *M. Z. 98310* (LE 233272). **Chukotka:** Iskaten' Range, 66°35'N, 179°10'W, 26.vii.1971, *I. Makarova* (LE 232806:a); Inchoun, 66°15'N, 170°20'W, 4.viii.1975, *I. Makarova* (LE 233151:a).

116. *Stigmidium stygnospilum* (Minks) R. Sant.

Notes. – Grows on damaged decorticated parts of host thalli. New to Asia and Russia.

Specimens Examined. Both specimens in rocky canyons on *Dermatocarpon miniatum* var. *complicatum* (th.). – **RUSSIA. Taimyr Pen.:** Bol'shaya Bootankaga River, 74°27'N, 97°52'E, alt. 250 m, 17.viii.1995, *M. Z. 95293* (LE 232826); N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 120 m, 27.viii.1995, *M. Z. 95291* (LE 232956).

117. *Stigmidium superpositum* (Nyl.) D. Hawksw.

Notes. – Pathogenicity not observed. Perithecia almost sessile, 150–250 µm diam. Ascospores hyaline, smooth–walled, (0–)1–septate, occasionally pseudotetrablastic, not constricted at the septum, (15–)16–19.5(–21) × 5–6(–7) µm (n = 46). New to the Arctic, Asia and Russia.

Specimens Examined. All specimens in tundra on *Polyblastia terrestris* (th.). – **RUSSIA. Taimyr Pen.:** N of Levinson–Lessing Lake, 74°31'N, 98°36'E, alt. 300–400 m, 20.vii.1995, *M. Z. 95403* (LE 233171); 24.vii.1995, *M. Z. 95402* (LE 233161). **Chukotka:** Gil'mymlineiveem River, 65°48'N, 173°15'E, 20.vii.1977, *I. Makarova* (LE 233363).

118. *Stigmidium tabacinae* (Arnold) Triebel

Notes. – In spite of its abundant development, pathogenicity not observed. New to Russia.

Specimen Examined. – **RUSSIA. Yakutiya:** Lena River delta, Stolb Is., 72°24'N, 126°40'E, alt. 100 m, rocks among tundra, on *Toninia sedifolia* (th.), 12.viii.1998, *M. Z. 98275* (LE 232916).

119. *Taeniolella diederichiana* Etayo & Calatayud

Notes. – Previously known only from Colombia, Peru and Canary Islands (Etayo & Calatayud 2005). New to the Arctic, Asia and Russia.

Specimen Examined. – **RUSSIA. Chukotka:** Gil'mymlineiveem River, 65°48'N, 173°15'E, nival scree tundra, on *Placopsis gelida* (th.), 18.vii.1977, *I. Makarova* (LE 233362).

120. *Taeniolella rolfii* Diederich & Zhurb.

NOTE. – New to Alaska.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kobuk Valley National Park, 67°00'N, 158°15'W, alt. 80 m, on *Cetraria aculeata* (lobe tips), 1.viii.2007, *T. Loomis* (LE 233470).

121. *Thelocarpon epibolum* Nyl. s. l.*

NOTES. – Mostly grows in slightly damaged parts of the lobes. Ascospores (5–)5.5–7 × 2–2.5 µm (n=13).

SPECIMEN EXAMINED. – **RUSSIA. TAIMYR PEN.:** S of Levinson–Lessing Lake, 74°24'N, 98°46'E, alt. 100 m, tundra, on *Solorina crocea* (upper lobe surface), 28.viii.1995, *M. Z. 95296* (LE 232906).

122. *Thelocarpon impressellum* Nyl.*

NOTES. – Apothecia truncated above, pale yellow–green, 150–175 µm diam., up to 150 µm tall, with opening to 50 µm wide, without an algal sheath. Paraphyses persistent, ca. 1 µm diam., unbranched. Hymenial gel I+ yellow–orange. Asci with I+ medium blue wall and I+ dark blue tholus. Ascospores simple, broadly elliptic, occasionally elliptic or rotund, (5–)5.5–7.5(–8) × 4–5 µm (n = 20, in I).

Pathogenicity not observed. The species is known to grow on moribund lichens, as well as on bryophytes, decaying wood, rocks etc. (Santesson et al. 2004). The only species of *Thelocarpon* previously reported on *Polyblastia* is *Thelocarpon cyaneum* Olech & Alstrup, which differs from *T. impressellum* by the absence of paraphyses and much smaller ascospores (Olech & Alstrup 1990). New to the Arctic, Asia and Russia.

SPECIMEN EXAMINED. – **RUSSIA. SEVERNAYA ZEMLYA:** Bol'shevik Is., Cape Antsev, 78°13'N, 103°15'E, alt. 30 m, polar desert, on *Polyblastia gelatinosa* (th.), 21.viii.1998, *N. Matveeva* (LE 233191).

123. *Trichosphaeria lichenum* P. Karst. & Har.

NOTE. – New to North America.

SPECIMEN EXAMINED. – **U.S.A. ALASKA:** Kenai Peninsula, near Chugach National Forest, 60°10'N, 149°27'W, alt. 30 m, *Picea sitchensis* dominated forest, on *Peltigera polydactylon* group (th.: mainly upper side, occasionally ap.), 1.ix.2000, *M. Z. 00429* (LE 233530).

124. *Zwackhiomyces berengerianus* (Arnold) Grube & Triebel

SPECIMEN EXAMINED. – **RUSSIA. YAKUTIYA:** Lena River delta, Cape Krest–Tumsa, 72°22'N, 126°42'E, alt. 50 m, tundra, on *Mycobilimbia carneoalbida* (th.), 4.viii.1998, *M. Z. 98309* (LE 233193).

125. *Zwackhiomyces macrosporus* Alstrup & Olech

NOTES. – Pathogenicity not observed. Perithecia 200–300 µm diam. In the protologue the size of the perithecia is given as ca. 100 µm (Alstrup & Olech 1993), which looks like a misprint considering the large size of the ascospores. Ascospores hyaline to pale grey when old, distinctly verruculose, 2–celled with the upper cell usually twice longer than the lower one, (29–)32.5–40.5(–45) × 10–12.5(–15) µm (n = 29). Previously known only from Svalbard on *Protopannaria pezizoides*. New to Asia and Russia. *Biatora* and *Protoblastenia* are new host genera.

SPECIMENS EXAMINED. – **RUSSIA. CHUKOTKA:** Gil'mymlineiveem River, 65°48'N, 173°15'E, rocks, on *Protoblastenia terricola* (th.), 23.vii.1977, *I. Makarova* (LE 233162); Sireniki, 64°24'N, 173°54'W, tundra, on *Biatora subduplex* (th.), 20.vii.1983, *I. Makarova* (LE 233173).

DISCUSSION

This catalogue includes 102 species of lichenicolous fungi and 23 lichens, mainly from the Russian Arctic. Three new species of lichenicolous fungi growing on cetrarioid lichens, viz. *Clypeococcum bisporum*, *Echinodiscus kozhevnikovii* and *Stigmidium hafellneri*, and a new form of lichen *Gypsoplaca macrophylla* are described.

Since the diversity of lichenicolous fungi in the Arctic, North America, Asia and Russia is realtively poorly explored, compared to Western Europe, there are in many biogeographic novelties. *Sclerococcum gelidarum* and *Zwackhiomyces macrosporus* were previously known only from their type localities. *Monodictys fuliginosa*, *Stigmidium microcarpum* and *Trichosphaeria lichenum* are new to North America. The following 21 species are new to Russia and Asia: *Arthophacopsis parmeliarum, Cercidospora lobothalliae, Clypeococcum placopsiphilum, Dactylospora* cf. *aeruginosa, D. frigida, Hypogymnia fistulosa, Lecanora luteovernalis, Lecanographa rinodinae, Lichenochora mediterraneae, Lichenopuccinia poeltii, Polycoccum ventosicola, Roselliniopsis gelidaria, R. ventosa, Sclerococcum gelidarum, Stigmidium croceae, S. mycobilimbiae, S. stygnospilum, S. superpositum, Taeniolella diederichiana, Thelocarpon impressellum, Zwackhiomyces macrosporus*. *Epicladonia sandstedei* and *Lichenosticta alcicorniaria* are new to Mongolia and Asia. Another five species are new to Asia: *Arthonia almquistii, Everniicola flexispora, Lichenopeltella peltigericola, Phoma cytospora, Scoliciosporum intrusum*. Seven species and one form are new to Russia: *Lecanora dispersa* f. *parasitans, Lichenostigma semiimmersum, Monodictys cellulosa, Psora nipponica, Rhizocarpon malenconianum, Spirographa fusisporella, "Stigmidium" aggregatum, Stigmidium leprariae, S. tabacinae*. Fifteen species and one form are new to the Arctic: *Arthophacopsis parmeliarum, Cercidospora lobothalliae, Clypeococcum placopsiphilum, Dactylospora* cf. *aeruginosa, D. frigida, Lecanora dispersa* f. *parasitans, Lecanographa rinodinae, Lichenochora mediterraneae, Phacopsis huuskonenii, Sclerococcum gelidarum, Sphaerellothecium parmeliae, S. phaeorrhizae, Stigmidium mycobilimbiae, S. superpositum, Taeniolella diederichiana* and *Thelocarpon impressellum*. Finds of *Cercidospora lobothalliae*, *Lichenochora mediterraneae* and *Taeniolella diederichiana* in the Arctic were rather unexpected, judging from their previously known distribution patterns. *Lichenostigma rugosum*, *Sphaerellothecium minutum* and *Stigmidium microcarpum* are new to Mongolia. *Abrothallus cladoniae, Dactylospora lobariella, Lettauia cladoniicola*, *Libertiella curvispora, Lichenopeltella santessonii, Nectriopsis lecanodes, Phaeopyxis punctum, Stigmidium mycobilimbiae*, and *Taeniolella rolfii* are new to Alaska. *Buellia elegans* is new to the Russian Arctic; *Diploschistes diacapsis* is new to Yakutiya; *Miriquidica garovaglii* is new to the Central Siberian Arctic. The presence of *Phacopsis huuskonenii* in Russia and of *Candelariella arctica* in the Russian Arctic is documented. Many reports are also new to various regions of Russia.

The following 23 lichen genera are new hosts for 14 species of lichenicolous fungi: *Asahinea* for *Abrothallus parmeliarum*; *Buellia* for *Cercidospora* cf. *lecidomae*; *Biatora* for *Cercidospora punctillata*; *Arctoparmelia* for *Cornutispora lichenicola*; *Lecidea*, *Lepraria*, *Phaeorrhiza* and *Stereocaulon* for *Dactylospora deminuta*; *Arthophacopsis*, *Asahinea* and *Bryocaulon* for *Lichenoconium lecanorae*; *Lecidoma* for *Merismatium decolorans*; *Buellia* for *Merismatium heterophractum*; *Brigantiaea*, *Bryonora*, *Fuscopannaria*, *Gyalecta*, *Lecanora*, *Lecidea*, *Lepraria*, *Polyblastia* and *Polychidium* for *Merismatium nigritellum*; *Mycoblastus* for *Muellerella lichenicola*; *Miriquidica* for *Muellerella ventosicola*; *Hypogymnia* and *Platismatia* for *Phaeosporobolus alpinus*; *Bryonora* for *Phoma caloplacae*; *Biatora* and *Protoblastenia* for *Zwackhiomyces macrosporus*. The lichen *Candelariella vitellina* is for the first time documented on *Placynthium*, *Japewia tornoënsis* on *Brodoa* and *Pseudephebe*, and *Thelocarpon impressellum* on *Polyblastia*.

The following 31 lichen species are new hosts for 20 species of lichenicolous fungi: *Parmelia omphalodes* for *Arthophacopsis parmeliarum*; *Lobothallia melanaspis* for *Cercidospora lobothalliae*; *Micarea incrassata* and *Psora rubiformis* for *Dactylospora deminuta*; *Arctoparmelia centrifuga* for *Echinothecium reticulatum*; *Amygdalaria elegantior* for *Endococcus rugulosus*; *Protoblastenia rupestris* and *Candelariella arctica* for *Intralichen christiansenii*; *Fuscopannaria praetermissa* for *Lichenochora mediterraneae*; *Caloplaca cerina*, *Lecanora luteovernalis* and *Melanelia stygia* for *Lichenoconium lecanorae*; *Caloplaca borealis* for *Lichenodiplis lecanorae*; *Lopadium pezizoideum* for *Merismatium heterophractum*; *Biatora cuprea*, *B. subduplex*, *Lopadium coralloideum*, *Micarea assimilata* and *Mycobilimbia carneoalbida* for *Merismatium nigritellum*; *Caloplaca ammiospila* for *Muellerella erratica*; *Caloplaca epiphyta* and *C. nivalis* for *Muellerella lichenicola*; *Bryoria nitidula* for *Phacopsis huuskonenii*; *Buellia geophila*, *Lecanora epibryon* and *Melanohalea septentrionalis* for *Phaeosporobolus alpinus*; *Melanelia disjuncta* for *Phoma cytospora*; *Peltigera collina* for *Libertiella curvispora* and *Scutula epiblastematica*; *Phaeorrhiza nimbosa* for *Sphaerellothecium phaeorrhizae*; *Melanohalea septentrionalis* for *Spirographa fusisporella*; *Vulpicida juniperinus* and *V. pinastri* for *Stigmidium microcarpum*.

There are not much data on the frequency of occurrence of lichenicolous fungi in nature. Some indirect evidence of this could be obtained from a list of the most frequently collected species from the present list: *Dactylospora deminuta* (36 finds), *Echinothecium reticulatum* (33), *Cercidospora punctillata* (21), *Merismatium nigritellum* (20), *Stigmidium conspurcans* (16), *Arthonia excentrica* (15), *Stigmidium microcarpum* (15), *Dactylospora amygdalariae* (14), *Lichenoconium lecanorae* (14), *Abrothallus parmeliarum* (13), *Carbonea vitellinaria* (13), *Rhymbocarpus neglectus* (12), *Merismatium heterophractum* (9), and *Muellerella lichenicola* (9).

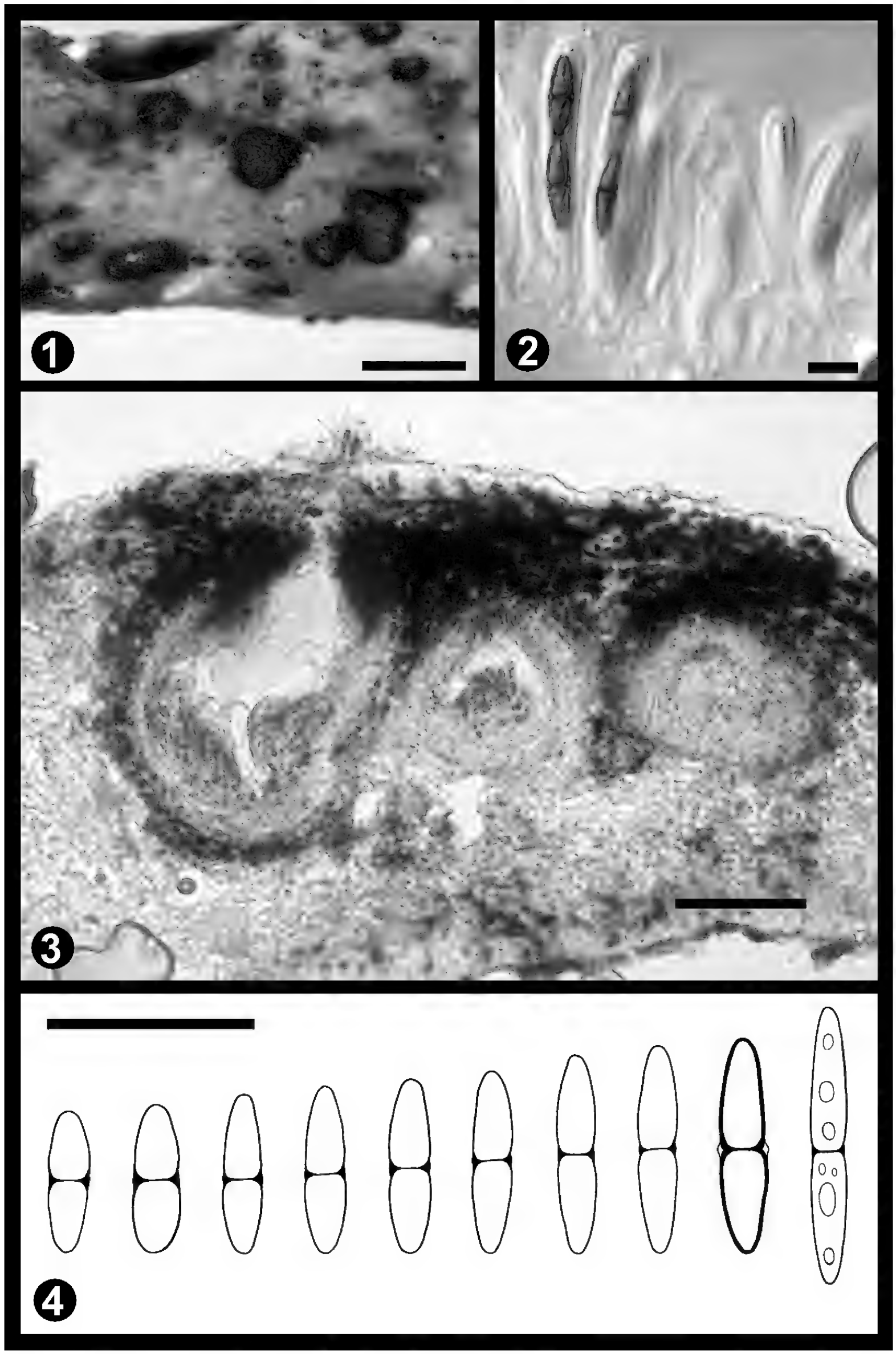

Plate 1. *Clypeococcum bisporum* (all from Zhurbenko 9867). Figure 1, habitus (scale = 0.5 mm). Figure 2, asci and pseudoparaphyses, (scale = 10 µm). Figure 3, cross section of perithecia in LCB (scale = 50 µm). Figure 4, ascospore outlines (scale = 25 µm).

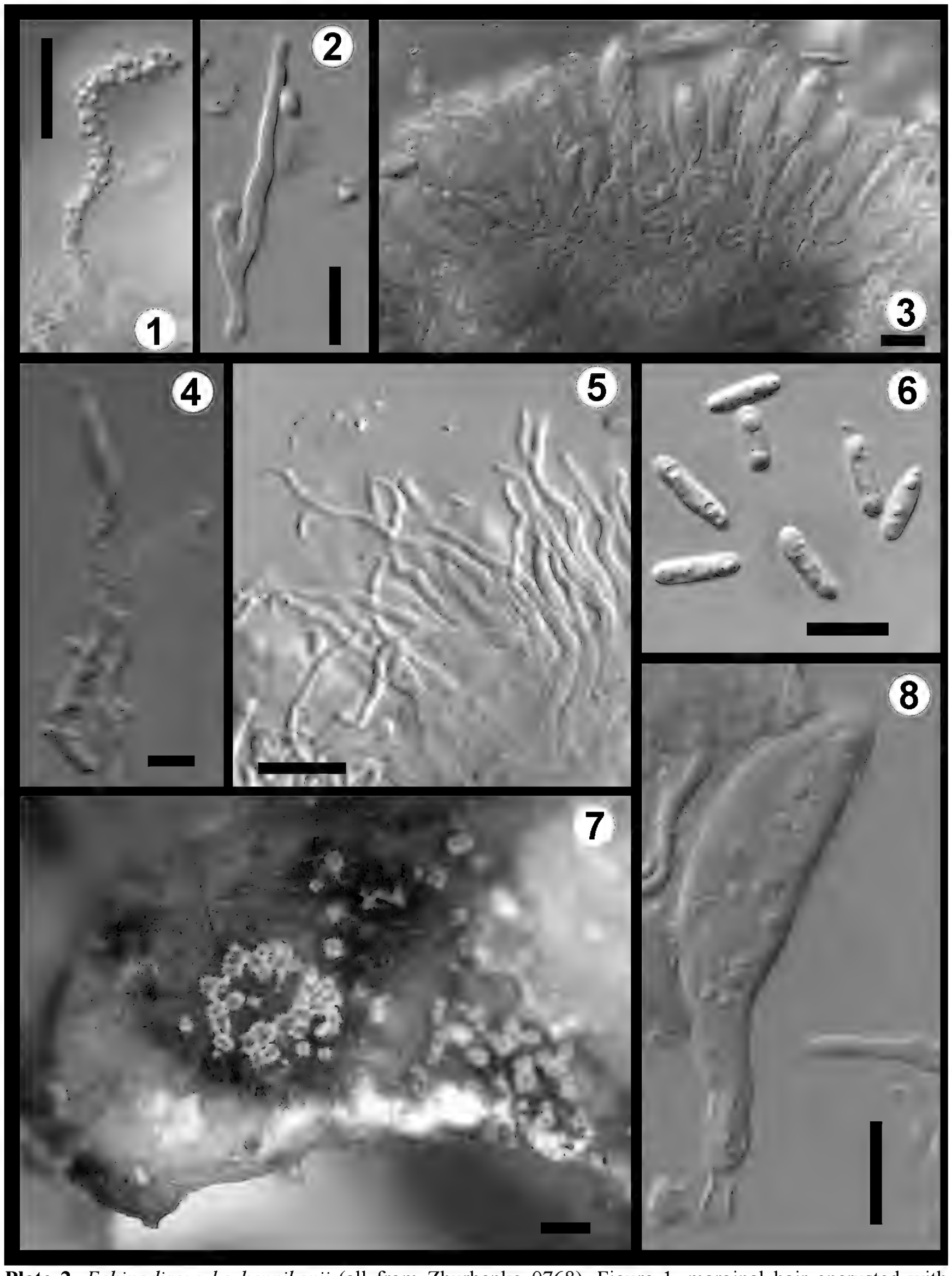

Plate 2. *Echinodiscus kozhevnikovii* (all from Zhurbenko 0768). Figure 1, marginal hair encrusted with hyaline granules (scale = 10 µm). Figure 2, branched paraphyse (scale = 10 µm). Figure 3, section of apothecium (scale = 10 µm). Figure 4, lumen of marginal hairs in phloxin (scale = 5 µm). Figure 5, marginal hairs in KOH, (scale = 10 µm). Figure 6, ascospores (scale = 10 µm). Figure 7, habitus (scale = 200 µm). Figure 8, ascus in Congo red (scale = 10 µm).

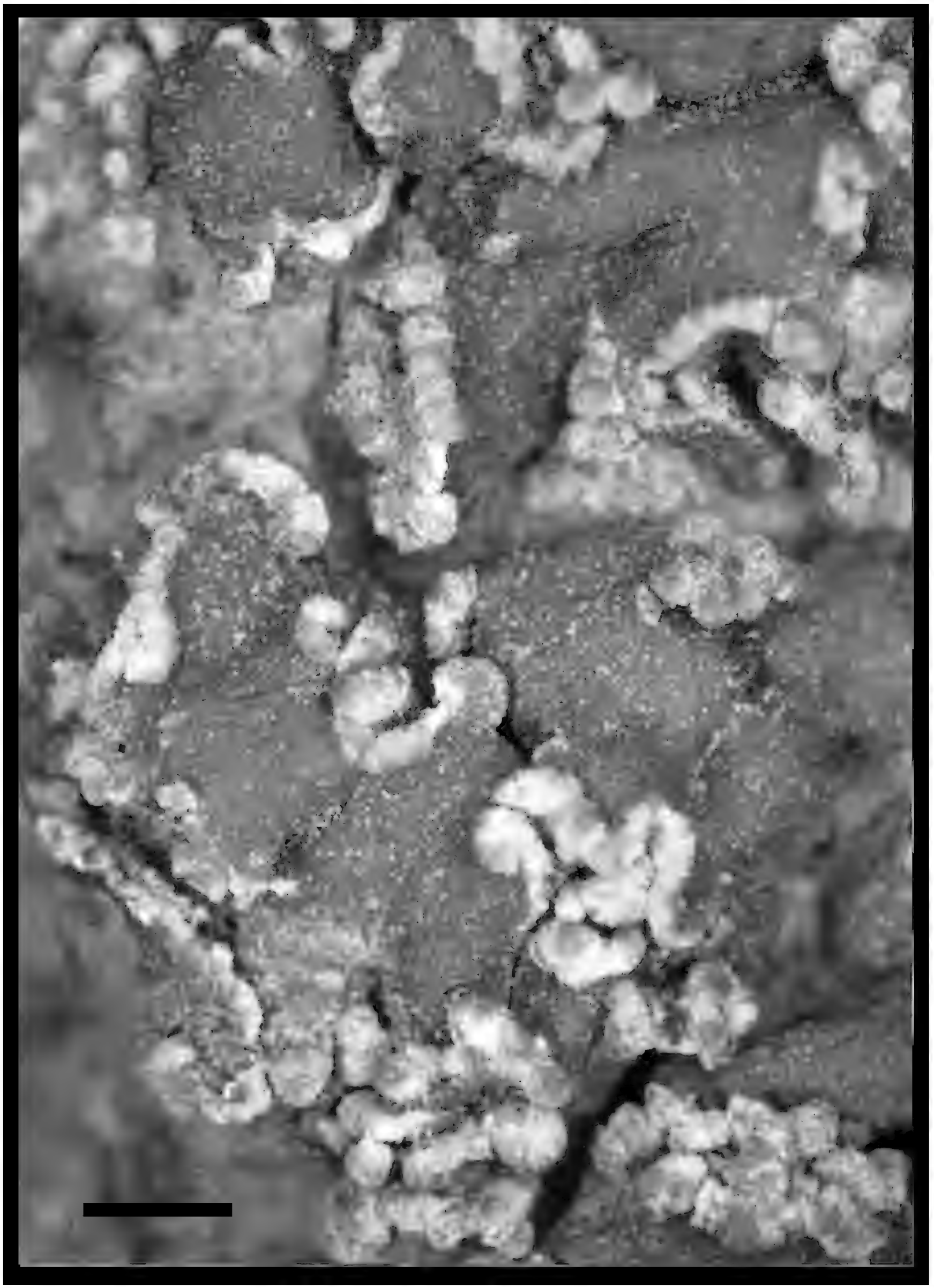

Plate 3. *Gypsoplaca macrophylla* f. *blastidiata*, habitus (Bredkina 1025; scale = 1 mm).

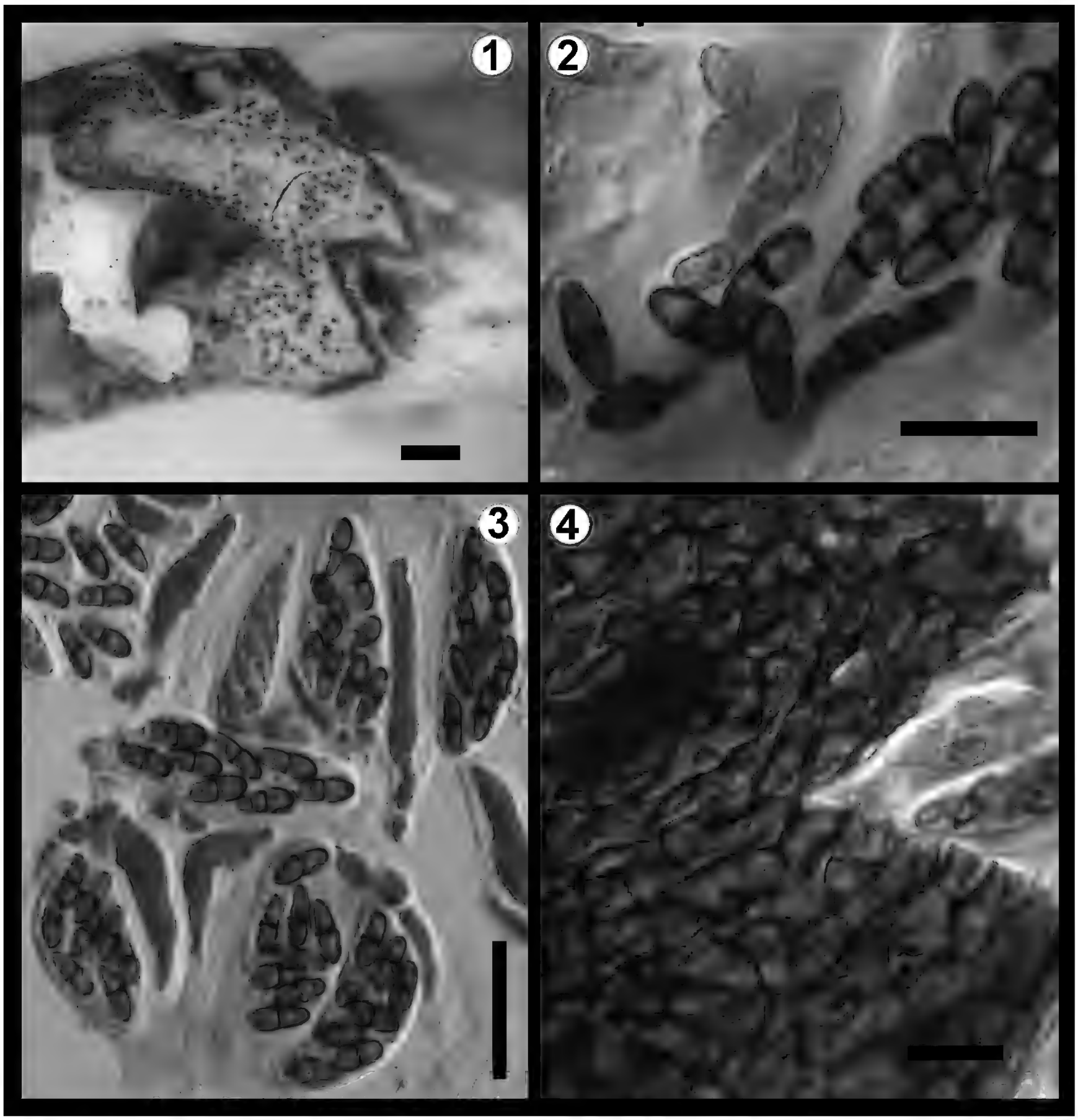

Plate 4. *Stigmidium hafellneri* (all from Zhurbenko 9854). Figure 1, habitus (scale = 0.5 mm). Figure 2, ascospores (scale = bar 10 µm). Figure 3, asci in BCr (scale = 20 µm). Figure 4, peridium (scale = 10 µm).

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Literature Cited

Alstrup, V. 1993. News on lichens and lichenicolous fungi from the Nordic countries. Graphis Scripta, 5(2): 96–104.

Alstrup, V. and M. Olech. 1993. Lichenicolous fungi from Spitsbergen. Polish Polar Research, 14(1): 33–42.

Andreev, M., Y. Kotlov, and I. Makarova, I. 1996. Checklist of lichens and lichenicolous fungi of the Russian Arctic. The Bryologist, 99(2): 137–169.

Berger, F. 2000. Beitrag zur Kenntnis der Flechten und lichenicolen Pilze Islands. Acta Botanica Islandica, 13: 69–82.

Biazrov, L.G. and P.M. Zhurbenko. 2004. New and rare lichen species from Khangai Upland (Mongolia). Botanicheskii Zhurnal [St.–Petersburg], 89(4): 663–667. (in Russ., Engl. summ.).

Brodo, I.M. 1981. *Lecanora luteovernalis*, a new species of the *L. symmicta* complex from the Canadian Arctic. The Bryologist, 84: 521–526.

Calatayud, V. 2004. *Polycoccum*. In: T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 684–686.

Diederich, P. 1986. Lichenicolous fungi from the Grand Duchy of Luxembourg and surrounding areas. Lejeunia, 119: 1–26.

Diederich, P. 2003. New species and new records of American lichenicolous fungi. Herzogia, 16: 41–90.

Elvebakk, A. and T. Tønsberg. 1992. Additions to the lichen flora of Svalbard. Graphis Scripta, 3(4): 140–147.

Ertz, D. 2004. *Clypeococcum*. *In:* T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 641–642.

Etayo, J. and V. Calatayud. 2005. *Taeniolella diederichiana*, a new lichenicolous hyphomycete on *Placopsis*. Lichenologist, 37(4): 303–305.

Etayo, J. and P. Diederich. 2000. *Echinodiscus lesdainii* gen. et comb. nov., a new name for *Phacopsis lesdainii* Vouaux (lichenicolous Ascomycetes, Leotiales). Bulletin de la Société des Naturalistes Luxembourgeois, 100: 63–66.

Grube, M. and J. Hafellner. 1990. Studien an flechtenbewohnenden Pilzen der Sammelgattung *Didymella* (Ascomycetes, Dothideales). Nova Hedwigia, 51(3–4): 283–360.

Hafellner, J. 1994. Beiträge zu einem Prodromus der lichenicolen Pilze Österreichs und angrenzender Gebiete. I. Einige neue oder seltene Arten. Herzogia, 10: 1–28.

Hafellner, J. 1998. Studien an lichenicolen Pilzen und Flechten. X. *Arthophacopsis* eine neue Gattung lichenicoler Ascomyceten (Arthoniales). Cryptogamie, Bryologie–Lichénologie, 19(2–3): 155–168.

Hansen, E.S. 2002. Lichens from Ammassalik Ø, Southeast Greenland. Folia Cryptog. Estonica, 39: 3–12.

Hansen, E.S., J. Poelt, and U. Søchting. 1987. Die Flechtengattung *Caloplaca* in Gronland. Meddelelser om Grønland, Bioscience, 25: 1–52.

Hawksworth, D.L. 1977. Three new genera of lichenicolous fungi. Botanical Journal of the Linnean Society, 75: 195–209.

Hawksworth, D.L. 1980. Notes on British lichenicolous fungi: III. Notes from the Royal Botanical Garden Edinburgh. 38: 165–183.

Hawksworth, D.L. 1981. The lichenicolous coelomycetes. Bulletin of the British Museum (Natural History), Botany Series, 9: 1–98.

Hawksworth, D.L. 1982. Notes on British lichenicolous fungi: IV. Notes from the Royal Botanical Garden Edinburgh, 40: 375–397.

Hawksworth, D.L. 1990. Notes on British lichenicolous fungi: VI. Notes from the Royal Botanic Garden Edinburgh, 46(3): 391–403.

Ihlen, P.G. 1998. The lichenicolous fungi on species of the genera *Baeomyces*, *Dibaeis*, and *Icmadophila* in Norway. Lichenologist, 30(1): 27–57.

Ihlen, P.G., H. Holien, and T. Tønsberg. 2004. Two new species of *Dactylospora* (Dactylosporaceae, Lecanorales), with a key to the known species in Scandinavia. The Bryologist, 107(3): 357–362.

Kainz, C. and D. Triebel. 2004. *Endococcus*. *In:* T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 648–651.

Kotlov, Yu. V. 2003. *Halecania*. *In:* Handbook of the lichens of Russia, Issue 8. St.–Petersburg, Nauka, pp. 104–107.

Lumbsch, H.T. and S.M. Huhndorf. 2007. Outline of Ascomycota – 2007. Myconet, 13: 1–58.

McCune, B. 2008. Three new species of *Hypogymnia* (Ascomycota: Parmeliaceae) from the Bering Sea region, Alaska and Russia. North American Fungi, 3(6): 1–10.

Navarro–Rosinés, P., V. Calatayud, and J. Hafellner, J. 2004. *Cercidospora*. *In:* T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 635–639.

Navarro–Rosinés, P., C. Roux, and X. Llimona. 1994. Nelikenigintaj fungoj ce *Squamarina*: *Clypeococcum epicrassum* comb. nov. kaj *Lichenochora clauzadei* sp. nov. (Ascomycetes). Bulletin de la Société Linnéenne de Provence, 45: 421–429.

Olech, M. and V. Alstrup. 1990. *Thelocarpon cyaneum* sp. nov. Nordic Journal of Botany, 9: 575–576.

Øvstedal, D. O. and D.L. Hawksworth. 1986. Lichenicolous ascomycetes from Bouvetoya. Norsk Polarinstitutt Skrifter, 185: 57–60.

Petersen, J.H. 1996. The Danish Mycological Society's Colour–chart. Copenhagen.

Piin, T. 1977. The new terricolous lichen from Taimyr Peninsula *Biatorella contigua* Golubk. et Piin species nova. Folia Cryptogamica Estonica, 7: 1–3.

Poelt, J. 1974. Bestimmungsschlussel Europaischer Flechten. Verlag von J. Cramer, Vaduz.

Raitviir, A. 2004. Revised synopsis of the Hyaloscyphaceae. Scripta Mycologica, 20: 1–133.

Roux, C. And D. Triebel. 1994. Révision des espèces de *Stigmidium* et de *Sphaerellothecium* (champignons lichénicoles non lichénisés, Ascomycetes) correspondant à *Pharcidia epicymatia* sensu Keissler ou à *Stigmidium schaereri* auct. Bulletin de la Société Linéenne de Provence, 45: 451–542.

Ryan, B.D., H.T. Lumbsch, M.I. Messuti, C. Printzen, L. Sliwa, and T.H. Nash III. 2004. *Lecanora*. *In:* T.H. Nash III, B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz. (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 176–286.

Santesson, R., R. Moberg, A. Nordin, T. Tønsberg, amd O. Vitikainen. 2004. Lichen–forming and lichenicolous fungi of Fennoscandia. Museum of Evolution, Uppsala University. 359 p.

Stearn, W.T. 1992. Botanical Latin. 4th edn. David & Charles Publishers, Newton Abbot, Devon, UK.

Timdal, E. 1990. Gypsoplacaceae and *Gypsoplaca*, a new family and genus of squamiform lichens. Bibliotheca Lichenologica, 38: 419–427.

Triebel, D. 1989. Lecideicole Ascomyceten. Eine Revision der obligat lichenicolen Ascomyceten auf lecideoiden Flechten. Bibliotheca Lichenologica, 35: 1–278.

Vainio, E.A. 1928. Enumeratio lichenum in viciniis fluminis Konda (circ. 60° lat. bor.) in Sibiria occidentali crescentium. Annales Academiae Scientiarum Fennicae, ser. A (IV Biol.), 27: 65–122.

Zedda, L. and H. Sipman, H. 2001. Lichens and lichenicolous fungi on *Juniperus oxycedrus* L. in Campu Su Disterru (Sardinia, Italy). Bocconea, 13: 309–328.

Zhurbenko, M.P. 2007. New lichenicolous fungi from Eurasia. Graphis Scripta, 19: 1–9.

Zhurbenko, M.P. 2008a. Lichenicolous fungi from Russia, mainly from its Arctic. II. Mycologia Balcanica, 5(1–2): 13–22.

Zhurbenko M.P. 2008b. Lichenicolous lichen species in Russian flora. Botanicheskii Zhurnal [St.–Petersburg], 93(9): 1329–1353. (in Russ., Engl. summ.).

Zhurbenko, M.P. and M.V. Gavrilo. 2005. The lichens of Oktyabrskoi Revolutsii Island (Severnaya Zemlya Archipelago). Botanicheskii Zhurnal [St.–Petersburg], 90(8): 1173–1184. (in Russ., Engl. summ.).

Zhurbenko, M.P., G.A. Laursen, and D.A. Walker. 2005. New and rare lichenicolous fungi and lichens from the North American Arctic. Mycotaxon, 92: 201–212.

Zhurbenko M.P. and N.V. Matveeva. 2006. Terricolous lichens of the Bol'shevik Island (Severnaya Zemlya archipelago). Botanicheskii Zhurnal [St.–Petersburg], 91(10): 1457–1484. (in Russ., Engl. summ.).

Zhurbenko, M.P. and R. Santesson. 1996. Lichenicolous fungi from the Russian Arctic. Herzogia, 12: 147–161.

Zhurbenko, M.P. and D. Triebel. 2003. *Cercidospora lecidomae* (Dothideales, Ascomycetes), a new lichenicolous fungus from the North Holarctic. Bibliotheca Lichenologica, 86: 205–214.

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Cladonia maritima, a new species in the *C. cervicornis* group from western North America

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ABSTRACT. – The populations historically referred to *Cladonia cervicornis* subsp. *verticillata* in southern California are recognized as a distinct species *C. maritima*. The species differs from *C. concinna* and other members of the *C. cervicornis* group that occur in California by its persistent primary squamules and comparatively short (1-2 tiered) and frequently squamulose podetia.

INTRODUCTION

In our study of the *Cladonia cervicornis* group in California (Knudsen & Lendemer 2006) we recognized the existence of populations in central and southern California that were not referable to *C. cervicornis* (Ach.) Flot. or *C. firma* (Nyl.) Nyl. and which often contained atranorin in addition to fumarprotocetraric acid. As a result of Ahti's revision of the *C. cervicornis* group in western North America (Ahti 2007) *C. cervicornis* s. str. has been excluded from the region with most populations being recognized as the new taxon *C. concinna* Ahti & Goward, leaving the taxon we studied undescribed. As such we take this opportunity to formally exclude *C. cervicornis* from California by describing the populations from the central and southern portions of the state as *C. maritima* K. Knudsen & Lendemer.

MATERIALS AND METHODS

Specimens were studied dry using a Baush & Lomb StereoZoom 7 dissecting microscope and all measurements of the thallus are based on examination of dry material. Images were taken using a CoolPix990 and prepared using Adobe Photoshop. Chromatography was performed using solvent C following the standardized methods of Culberson and Kristinsson (1970).

TAXONOMIC SECTION

To facilitate the identification of specimens, and to aid users of the Sonoran Flora we present below a key to the members of the *Cladonia cervicornis* group occurring in California. The key includes the recently described *C. concinna* as well as *C. firma, C. macrophyllodes* Nyl., and *C. maritima*, taxa that occurred outside the range of the recent treatment of the group by Ahti (2007).

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Key to the *Cladonia cervicornis* group in California

1. Primary squamules large (>5 mm long) and lobate.....2

    2. Primary squamules with conspicuous raised bumps on upper surface; reported from San Mateo County and northward.....***C. macrophyllodes***
    2. Primarily squamules smooth; known from Los Osos area in San Luis Obispo County.....***C. firma***

1. Primary squamules smaller (<5mm long) and not distinctly lobate.....3

    3. Primary squamules persistent and frequently erect and curling inwards; podetia short, 1–2– (3) tiered, squamulose; in maritime habitats in southern California.....***C. maritima***
    3. Primary squamules not persistent, quickly disappearing as podetia develop; podetia tall, with >3 tiers, usually lacking squamules, in various habitats, central and northern California....***C. concinna***

Description of *Cladonia maritima*

Cladonia maritima **K. Knudsen & Lendemer sp. nov.**
Mycobank #513016.

Thallus primarius persistens, squamulosus, squamis 3–4 mm longis. Podetia rufescentia, basi conspicue melanotica, ad 16 mm alta, distincte gracilia, scyphosa, scyphis squamulosis, non angustis, a centro proliferis, 1–2 verticillos formantia, cortice non continuo, areolato, minutissime pruinoso. Hymenia rufa. Acidum fumarprotocetraricum et interdum etiam atranorinam continens.

Type: **U.S.A. CALIFORNIA.** RIVERSIDE CO.: Cleveland National Forest, Santa Ana Mountains, upper Mateo Canyon, vicinity of Tenaja Canyon, 33º33'04"N, 117º23'06"W, 442.5 m, moist N-facing slope with volcanic outcrops, on soil and organic matter with *Selaginella bigelovii*, 13.i.2008, *J.C. Lendemer 11401 & K. Knudsen* (NY, holotype; UCR isotype).

Description. – *Primary squamules* persistent, 3–4 x 1–2.5 mm, usually brown above, white below, erect and curling to reveal underside, esorediate, little divided. *Podetia* usually brown, with podetial squamules, necrotic bases finally blackening, up to 16 mm tall, often shorter, often lacking, not forming clumps, with stalks 0.5–1 mm wide at mid-level, slender, rarely branching from base, usually one tiered, rarely two tiered, usually 1–3 proliferating centrally from scyphi, but proliferations rare, tips always scyphose, without perforations or slits, scyphal plate flat, margins irregular and frequently squamulose, with pycnidia or apothecia. *Surface* of podetia corticate, areolate, with discontinuous areoles becoming squamules, appearing smooth or slightly uneven, not minutely pruinose or arachnoid, matt. *Conidiomata* frequent at scyphal margins, dark brown to black, barrel-shaped, 0.1–0.2 mm wide, conidia not seen. *Apothecia* infrequent, often only occurring on mature proliferating scyphi, sessile, dark brown, ascospores not seen.

Chemistry. – Fumarprotocetraric acid, with traces of protocetraric acid. Atranorin is also present in variable concentrations in some populations. Spot tests: K+ weak yellow or more often K–, KC+ weak purple/brown, C–, PD+ orange-red, UV–.

Etymology. – The epithet "*maritima*" refers to the maritime distribution of the species in California.

Ecology and Distribution. – On soil, or humus over rocks in open habitats, or at the base of chaparral often associated with *Selaginella bigelovii* L. Underw., frequent in the maritime belt from San Diego to Santa Barbara County. The type locality represents the most inland populations in an area of the Santa Ana Mountains where a number of maritime species including *Dimelaena radiata* (Tuck.) Müll. Arg. and *Acarospora robiniae* K. Knudsen also have populations over twenty miles (32 km) from the coast in a fog corridor. The distribution of *C. maritima* north of Santa Barbara County needs verification, but it has been observed near the Point Reyes Lighthouse in Marin County on maritime hills, during the recent IAL excursion (July 2008).

Plate 1. Well developed podetia from holotype of *Cladonia maritima* with squamulose scyphi, darkened bases, and persistent squamules at base (left). Geographic distribution of *C. maritima* as presently known (right).

Discussion. – We follow Ahti (2007) in excluding *Cladonia. cervicornis* s. str. from western North America and recognizing *C. verticillata* (Hoffm.) Schaer. as a distinct species restricted to the northwestern and eastern portions of North America. The populations from western North America, from British Columbia to central California, which have been historically determined as *C. cervicornis* subsp. *verticillata* (Hoffm.) Ahti are now recognized as a distinct species, *C. concinna* (Ahti 2007). Although Ahti (2007) revised the status of most western North American populations of *C. cervicornis* s. lat., the populations primarily from central and southern California (Ahti & Hammer 2002) were left untreated, as were the disjunct North American populations of *C. firma* from San Luis Obispo County in central California (Knudsen & Lendemer 2006, 2007). In reviewing this paper, T. Ahti said he is uncertain about a northern squamulose "cervicornis" taxon of the British Columbia coast and arid interior areas.

Cladonia maritima has long been misidentified as *C. cervicornis* in central and southern California (Ahti and Hammer 2002). The species is easily distinguished from *C. concinna* and *C. verticillata*, which are the most common members of the *C. cervicornis* group in North America (Ahti 2007), by having one to two tiered squamulose podetia and persistent brown primary squamules. It has also occasionally been misidentified as *C. firma* but differs in having much smaller unlobed primarily squamules. In North America *C. firma* is restricted to stabilized sand dunes at several scattered locations in Los Osos, San Luis Obispo County, California (Knudsen & Lendemer 2006, 2007). Compared to the European *C. cervicornis* s. str. the new species has no tendency to have bluish color on the underside of the squamules or glossy upper surface. *C. cervicornis* probably never produces atranorin, either.

We have not found *Cladonia maritima* growing with *C. firma* or *C. concinna*. In our experience it is usually associated with *C. hammeri* Ahti and *C. nashii* Ahti & Hammer in maritime habitats. Frequently *C. maritima* forms large sterile populations.

Additional Specimens Examined – **U.S.A. CALIFORNIA.** LOS ANGELES CO.: Santa Monica Mountains, Zuma Ridge, 34°05'N, 118°49'W, N side of sandstone outcrop, 613 m, on soil, 31.i.2004, *K. Knudsen 811 & T. Sagar* (UCR). RIVERSIDE CO.: Cleveland National Forest, Santa Ana Mountains, upper Mateo Canyon, vicinity of Tenaja Canyon, 33°33'04"N 117°23'06"W, 442 m, moist N-facing slope with volcanic outcrops, on soil and organic matter with spike moss, 13.i.2008, *J.C. Lendemer 11400 & K. Knudsen* (NY, UCR). SANTA BARBARA CO.: Santa Rosa Island, Arlington Canyon, at conjunction with side canyon, NE of Smith Hwy., 33° 58'26"N 120°08'28"W, 106 m, soil among boulders in sun, 20.vii.2007, *K. Knudsen 8724, J. Kocourková & S. Chaney* (NY, UCR); Upper Torrey Pines Road, 33°58'50"N, 120°01'40"W, 132 m, at edge of the *Pinus torreyana* grove, on soil with *Selaginella bigelovii* among native bunch grasses, 15.x.2006, *K. Knudsen 7530 & S. Baguskus* (PRM, UCR). SAN DIEGO CO.: Del Mar, near Del Mar High School, end of Del Mar Scenic Pky., 114 m, coastal sage scrub/chaparral, uncommon on soil, 18.ii.2001,

R.E. Riefner 01-67 (UCR); Torrey Pines State Park, 32°55'N, 117°15'W, 78 m, openings in chaparral, on sand, 28.iv. 2004, *K. Knudsen 1097* (UCR); Point Loma, Cabrillo National Monument, on bluff below Bayside Trail, 32°40'18"N 117°14'12"W, 85 m, coastal sage scrub and *Euphorbia misera*, on soil and detritus, 21.vii.2007, *K. Knudsen 8585 & J. Good* (UCR); St. Elijo Lagoon, 33°00'52"N, 117°14'16"W, 37 m, in maritime chaparral on soil, 25.iii.2005, *K. Knudsen 2566 & A. Sanders* (UCR).

Selected Specimens of Cladonia Concinna Examined. – **U.S.A. CALIFORNIA.** DEL NORTE CO.: Hwy. 199, E of 6 Rivers National Forest entrance, 13.xi.1987, *S. Hammer 2202* (NY). **OREGON.** DOUGLAS CO.: Tahkenitch Campground, Oregon Dunes National Recreation Area, 0 m, on compressed duff over stabilized sand dune, semi-exposed roadside, 3.vi.1989, *S. Hammer 3447* [*Clad. Amer. Exs. 23*] (NY). LANE CO.: Siltcoos Beach Access Road, Oregon Dunes National Recreation Area, 0 m, on thin soil over stabilized sand dune, 3.vi.1989, *S. Hammer 3490* [= *Clad. Amer. Exs. 22*] (NY). **WASHINGTON.** MASON CO.: Hamma Hamma Recreation Area Road, ca. 5 km W of Hwy. 101, 200 m, on thin soil, *S. Hammer 4379* [= *Clad. Amer. Exs. 24*] (NY).

Acknowledgements

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Literature Cited

Ahti, T. 2007. Further studies on the *Cladonia verticillata* group (Lecanorales) in East Asia and western North America. *In:* A. Frisch, U. Lange and B. Staiger: Lichenologische Nebenstunden. Contributions to Lichen Taxonomy and Ecology in Honour of Klaus Kalb. Bibliotheca Lichenologica, no. 96. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin-Stuttgart, pp. 5–19.

Ahti, T., and S. Hammer. 2002. *Cladonia*. *In:* Nash III, T.H., B.D. Ryan, C. Gries and F. Bungartz (eds.): Lichen Flora of the Greater Sonoran Desert Region. I. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 131–158.

Culberson, C.F., and H. Kristinsson. 1970. A standardized method for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Knudsen, K., and J.C. Lendemer. 2007. *Cladonia firma*, sponsorship for the CALS Conservation Committee. Bulletin of the California Lichen Society, 14(2): 40–44.

Knudsen, K., and J.C.Lendemer. 2006. *Cladonia firma* in San Luis Obispo County, California. Bulletin of the California Lichen Society, 13(2): 29–34.

Opuscula Philolichenum, **6**: 125–136. 2009.

Contributions to the lichen flora of Pennsylvania: Notes on the lichens of a remarkable talus slope in Huntingdon County

James C. Lendemer[1], Harry M. Edenborn[2], and Richard C. Harris[3]

ABSTRACT. – The authors present the results of a preliminary survey of a botanically significant talus slope in Huntingdon County, Pennsylvania, known locally as the Spruce Creek Ice Caves. The site is representative of the so-called "cold trap" phenomenon long known outside the field of lichenology, which allows northern/boreal species to persist at locations far south of their present-day primary range. The lichen biota of the site is significant for the presence of numerous rare and disjunct species, including *Arctoparmelia centrifuga, Baeomyces carneus, Chrysothrix chlorina, Cladonia coccifera, C. floerkeana, C. stygia, Microcalicium arenarium, Porpidia tuberculosa, Protothelenella corrosa, Rhizocarpon subgeminatum, Stereocaulon glaucescens,* and *Vulpicida pinastri*. Fifteen species are newly reported for the Commonwealth of Pennsylvania.

Introduction

In his classic text, "Glacières or freezing caverns," published in 1900, noted climatologist Edwin S. Balch described many anomalous cold sites in temperate Europe and North America. At these locations, ice was known to persist well into the summer months, if not year-round, despite the warm regional temperatures. He visited many of these sites, meticulously describing their geologic and geographic settings. He also recorded the accounts and beliefs of the local residents regarding the seasonal appearance and disappearance of ice. His goals were to both develop a unifying concept regarding the apparently unusual summertime presence of ice and cold temperatures at these locations, as well as to debunk commonly-held public myths regarding the phenomenon. The most enduring belief among them was that such sites actually became colder in the spring and summer, accounting for the springtime appearance of ice and the perpetuation of cold temperatures in the summer months.

Balch ultimately concluded that most examples of ice formation in the spring and early summer were consistent with the winter displacement of warm air in caverns or rock slopes by heavy cold air, which also cooled the surrounding rock. As temperatures warmed in the spring, and water from rainfall and thawed ice and snow came into contact with subsurface rock still at temperatures well below freezing, ice was formed in these "cold traps," which acted like natural refrigerators. Ice in such rock–insulated pockets tended to resist melting until well into the summer, often much to the amazement of the local populace. This general phenomenon was later referred to among climatologists as the "Balch Effect," and while other variations on this explanation better describe the formation of ice at specific locations (e.g. Harris & Pedersen 1998), Balch's explanation provides a satisfactory explanation for most.

Balch referred to one North American site he visited in 1898 as the "freezing rock talus of Spruce Creek," located in Huntingdon Co., Pennsylvania (Balch 1900). This place was known to local residents as the "ice holes" or "ice caves," and was found at the base of a large and forested periglacial talus slope at the foot of Tussey Mountain. Balch was told that ice usually persisted there until late summer, and that ice

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cream picnics were often held by the nearby residents up until that time. He visited on October 5th, and although no ice could be seen on that late date, he noted that "icy cold draughts" came from cracks in the rock talus, and he was certain that buried ice was responsible for them (Balch 1900). Significantly, he noted that:

> *"Although I am not much of a botanist, yet it seemed to me that the flora immediately near the talus was somewhat different in character from that of the surrounding country."*

A previous article in the *Philadelphia Ledger* (July 6, 1896) regarding the Spruce Creek Ice Caves likely first brought Balch's attention to the site. There it was also mentioned that varieties of plants "strongly arctic in character" were found near ice deposits on the talus slope. The local area was later more precisely described as a rich hemlock-mesic hardwoods forest dominated by hemlock (*Tsuga canadensis*), and including more northerly plants such as mountain ash (*Sorbus americana*), Canadian yew (*Taxus canadensis*), skunk currant (*Ribes glandulosum*), and twinflower (*Linnaea borealis*) (Western Pennsylvania Conservancy 2004).

During a recent investigation of the thermal characteristics of the Spruce Creek talus slope described by Balch, one of us (HME) noticed a lichen species growing abundantly on sandstone rock in full sunlight that appeared to be unusual for the region. This lichen was subsequently identified as *Stereocaulon glaucescens*, a lichen common in boreal New England (Hinds & Hinds 2008), but previously unknown from the Commonwealth of Pennsylvania. Stimulated by the discovery of this disjunct population of *S. glaucescens*, we conducted a more thorough investigation of the site, which revealed the presence of numerous additional lichens unusual to Pennsylvania. We present the results of our investigation here, and discuss the significance of the lichen biota of this fascinating locality in the broader context of the lichen biota of the Commonwealth of Pennsylvania.

Annotated Checklist

We have chosen to precede the discussion of the Spruce Creek Ice Caves with an annotated checklist of the lichens and lichenicolous fungi found at this locality. This checklist is arranged alphabetically by genus and species with taxonomy generally following Esslinger (2008), any deviations from which represent the views of the authors (JCL and RCH). Representative vouchers of all collections have been deposited in the herbarium of The New York Botanical Garden (hereafter NY) and these data are available online via the C.V. Starr Virtual Herbarium (http://sciweb.nybg.org/science2/VirtualHerbarium.asp). Brief discussions have been inserted in the list as deemed necessary. Lichenicolous fungi are denoted with an asterisk (*). New records for the Commonwealth of Pennsylvania are denoted with a dagger (†) and have been incorporated into the online checklist of lichens and lichenicolous fungi of Pennsylvania (http://sciweb.nybg.org/science2/hcol/lena/index.asp).

Anisomeridium polypori (Ellis & Everh.) M.E. Barr – *Lendemer 11743.*

Arctoparmelia centrifuga (L.) Hale † – *Lendemer 11727, Lendemer 11747.*

Brodo et al. (2001) map this taxon as being restricted to the arctic–boreal regions of North America, with a southern limit of northern New York in the eastern half of the continent. Based on the herbarium materials at NY, this species also occurs as scattered disjunct populations at high elevations in the Appalachian Mountains (Hodkinson et al. in press, and Plate 1). This is the first report of *A. centrifuga* from Pennsylvania.

Baeomyces carneus Flörke † – *Harris 54226.*

Baeomyces carneus is a species widespread in northern boreal regions of North America that differs from *B. rufus* (Huds.) Rabent., essentially in the production of norstictic acid rather than stictic acid. While *B. rufus* is common in northeastern Pennsylvania (Lendemer, unpublished data), *B. carneus* is otherwise unknown from the Commonwealth.

Chaenotheca furfuracea (L.) Tibell – *Harris 54202.*

Chrysothrix chlorina (Ach.) J.R. Laundon † – *Lendemer 11707.*

As has been discussed by Harris and Ladd (2008), *C. chlorina* is a rare species in North America, with a northern-boreal distribution. This is the first report of the species from Pennsylvania, and the first confirmed report south of Ontario and Vermont (Plate 1). This species is easily separated from *C. onokoensis* (Wolle) R.C. Harris and Ladd by chemistry (calycin, vulpinic acid and zeorin in *C. chlorina* vs. leprapinic acid? in *C. onokoensis*).

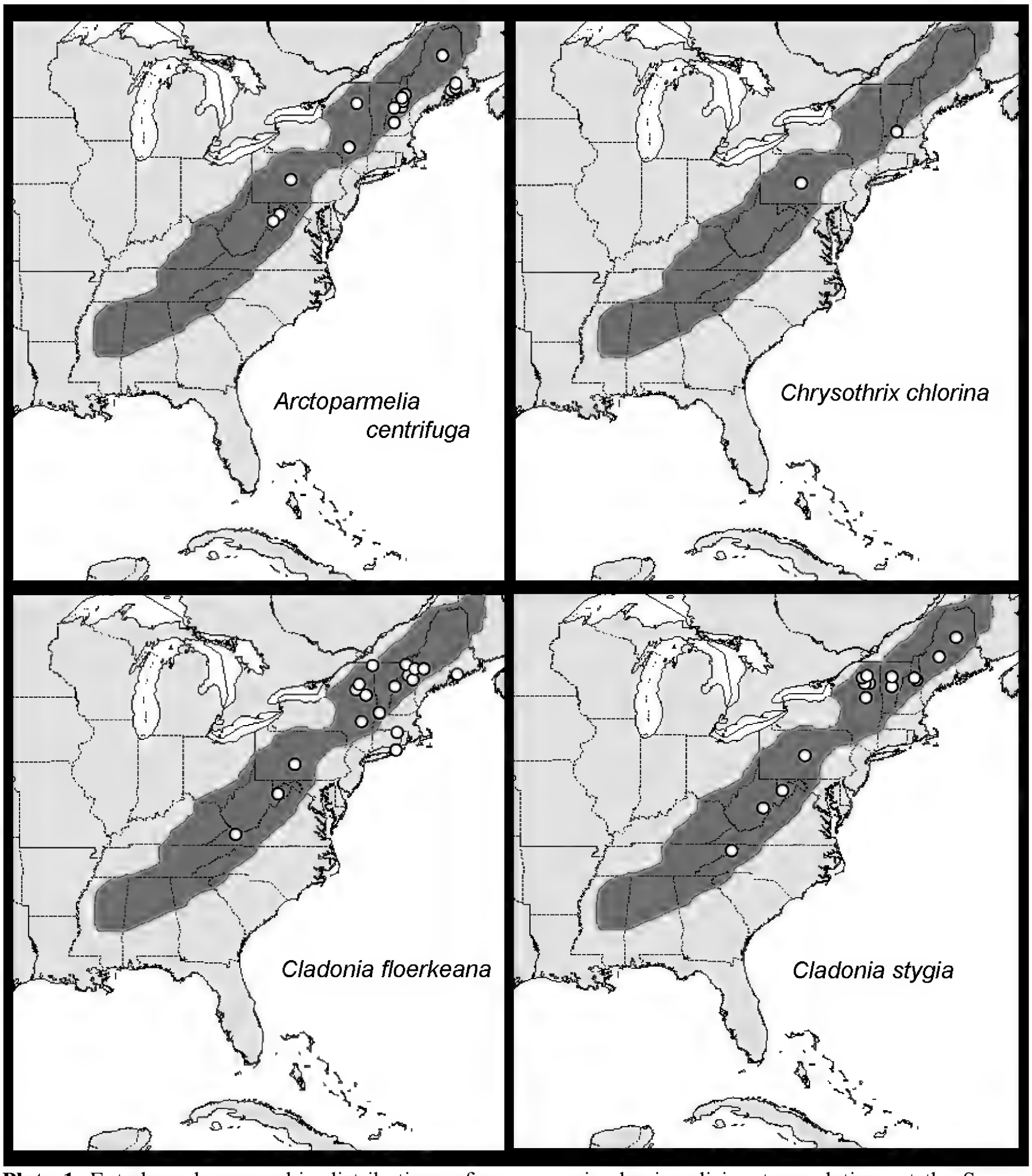

Plate 1. Extraboreal geographic distributions of some species having disjunct populations at the Spruce Creek locality (based on herbarium materials at NY). The darkened region approximates the Appalachian Mountains.

Cladonia coccifera (L.) Willd.† – *Harris 54203, Harris 54214, Lendemer 11699, Lendemer 11708, Lendemer 11718, Lendemer 11724.*

An illustration of *Cladonia coccifera* can be found in Hinds and Hinds (2008). The species is chemically similar to *C. pleurota* in producing usnic acid and zeorin, however it differs in having corticate/areolate rather than sorediate podetia. *Cladonia coccifera* is widespread in boreal-arctic regions of North America and is previously unknown from Pennsylvania. Disjunct populations of this taxon are known from cold air flows in middle–high elevation granitic balds of the southern Appalachians (Lendemer unpublished data; Lendemer & Tripp 2008).

Cladonia floerkeana (Fr.) Flörke † – *Harris 54206, Lendemer 11719.*

Brodo et al. (2001) map this taxon as being widely distributed in eastern North America: however, in our experience, it is primarily northern–boreal, as is evidenced by the specimens at NY (Plate 1). We suspect most specimens are misidentifications of *Cladonia macilenta* Hoffm. This is the first confirmed report of *C. floerkeana* from Pennsylvania.

Cladonia grayi G. Merr. *ex* Sandst. – *Harris 54196, Harris 54218, Lendemer 11731.*

All specimens of this taxon cited here contain fumarprotocetraric acid in addition to grayanic acid.

Cladonia incrassata Flörke – *Harris 54197.*

Cladonia macilenta Hoffm. var. *bacillaris* (Genth.) Schaer. – *Harris 54227.*

Cladonia macilenta Hoffm. var. *macilenta* – *Harris 54211, Harris 54223, Lendemer 11728, Lendemer 11729.*

Cladonia pleurota (Flörke) Schaer. – *Harris 54195, Harris 54230.*

Cladonia rangiferina (L.) F.H. Wigg. – *Harris 54198, Lendemer 11740.*

Dirig (1994) included this taxon among those he considered "northern boreal". As is illustrated by Brodo et al. (2001), this taxon is actually quite widespread in eastern North America, occurring as far south as central Alabama, Georgia, and Mississippi.

Cladonia sobolescens Nyl. *ex* Vainio – *Lendemer 11742.*

Cladonia squamosa Hoffm. – *Harris 54210, Harris 54225, Harris 54228, Lendemer 11753.*

Cladonia strepsilis (Ach.) Grognot – *Lendemer 11730.*

Cladonia stygia (Fr.) Ruoss † – *Harris 54222.*

Cladonia stygia resembles *C. rangiferina*, differing especially in the blackened bases of the podetia, and can be easily misidentified in the field if one is not familiar with it. The species is primarily known from open bogs in the boreal and arctic regions of North America, with disjunct populations in the high elevations of the southern Appalachians (Brodo et al. 2001). This is the first report of *C. stygia* from Pennsylvania (Plate 1).

Cladonia uncialis (L.) F.H. Wigg. – *Lendemer 11751.*

Coenogonium pineti (Ach.) Lücking & Lumbsch – *Buck 53520.*

Diploschistes scruposus (Schreb.) Norman – *Harris 54213, Lendemer 11746.*

Epigloea pleiospora Döbbeler – *Buck 53519.*

Fellhanera silicis R.C. Harris & Ladd – *Buck 53509.*

Flavoparmelia baltimorensis (Gyeln. & Fóriss) Hale – *Lendemer 11752.*

Flavoparmelia caperata (L.) Hale – *Lendemer 11715.*

Fuscidea recensa (Stirt.) V. Wirth et al. – *Lendemer 11732.*

Graphis scripta (L.) Ach. – *Lendemer 11735.*

Hypocenomyce scalaris (Ach.) M. Choisy – *Lendemer 11703.*

Hypogymnia physodes (L.) Nyl. – *Lendemer 11696.*

Hypotrachyna showmanii Hale – *Buck 53511, Lendemer 11737.*

Imshaugia aleurites (Ach.) S.L.F. Mey. – *Lendemer 11701.*

Lasallia papulosa (Ach.) Llano – *Buck 53513, Harris 54205, Lendemer 11717, Lendemer 11722.*

Lepraria caesiella R.C. Harris – *Harris 54209.*

Lepraria caesioalba (de Lesd.) J.R. Laundon – *Harris 54220.*

Lepraria lobificans Nyl. – *Harris 54207.*

Lepraria normandinoides Lendemer & R.C. Harris – *Lendemer 11713, Lendemer 11738.*

Micarea peliocarpa (Anzi) Coppins & R. Sant. – *Buck 53524.*

Microcalicium arenarium (A. Massal.) Tibell*† – *Buck 53536* (on *Psilolechia lucida*).

This is a rare lichenicolous taxon, previously unknown from Pennsylvania. The distribution of this taxon in North America likely follows that of its host, *Psilolechia lucida*.

Muellerella erratica (A. Massal.) V. John & Hafellner*† – *Lendemer 11744* (on *Porpidia tuberculosa*).

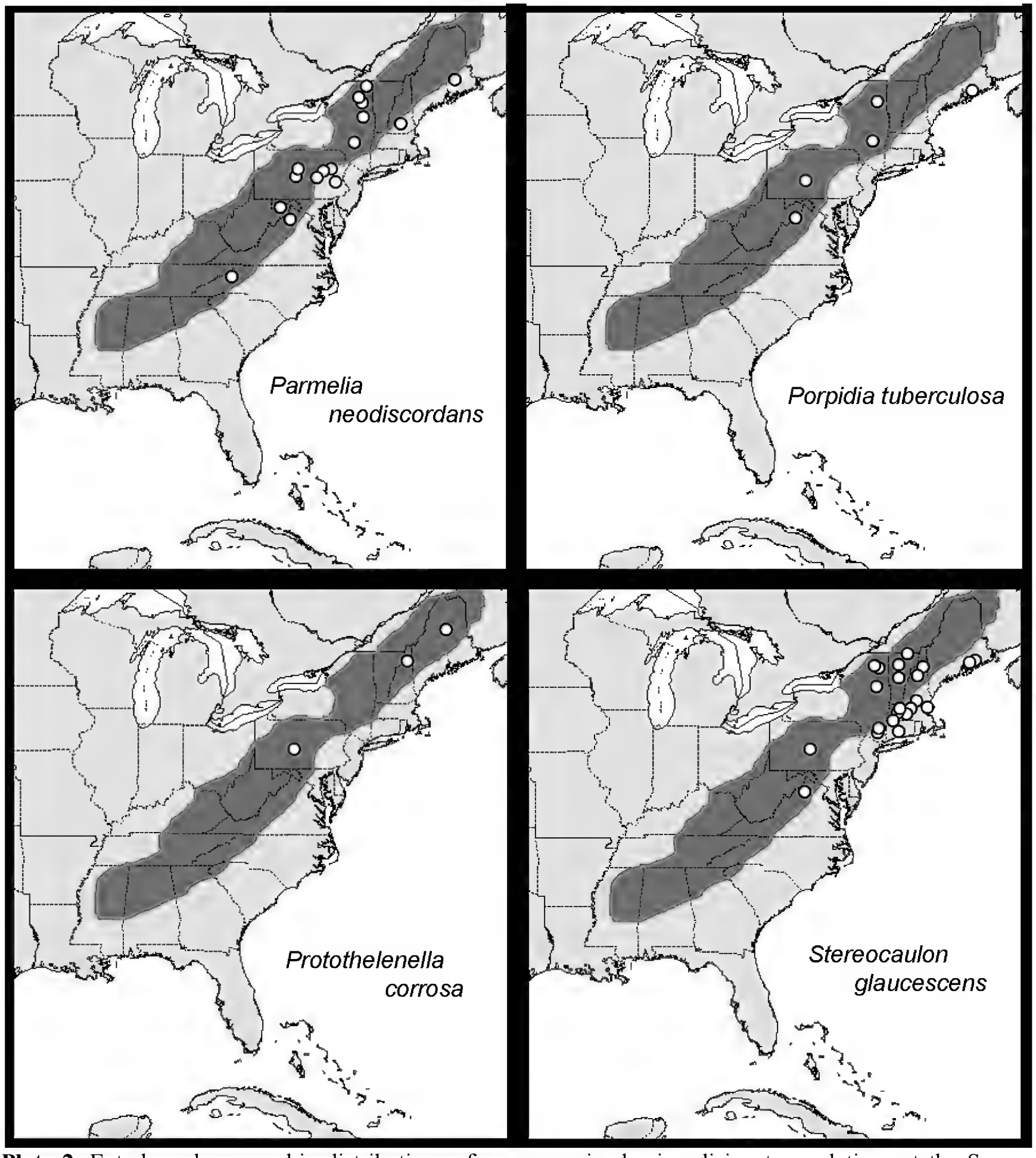

Plate 2. Extraboreal geographic distributions of some species having disjunct populations at the Spruce Creek locality (based on herbarium materials at NY). The darkened region approximates the Appalachian Mountains.

Opegrapha varia Pers.† – *Buck 53500, Lendemer 11705.*

Parmelia neodiscordans Hale – *Buck 53499, Lendemer 11750.*

Hale (1987) described this taxon from several localities in Maine, New York, and West Virginia. Although the species seems to be rare throughout most of its range (e.g. Hinds & Hinds 2008), it is actually quite common on talus slopes and rocky openings in northeastern Pennsylvania (Plate 2) and the Commonwealth may actually represent the center of its distribution.

Parmelia sulcata Taylor – *Lendemer 11736.*

Porpidia albocaerulescens (Wulfen) Hertel & Knoph – *Harris 54215.*

Porpidia tuberculosa (Sm.) Hertel & Knoph † – *Lendemer 11741.*

Porpidia tuberculosa is a common sorediate saxicolous crustose lichen of northern regions in North America; however, it is underreported as are most asexually reproducing crustose lichens. It is easily recognized by its white thallus and the presence of confluentic acid (UV+ blue-white, K+ bubbles in a water mount) and an amyloid (I+ blue) medulla. The species is also a common host for the lichenicolous fungus *Muellerella erratica*. Both *P. tuberculosa* and *M. erratica* are new reports for the State of Pennsylvania. While the distribution of *M. erratica* in eastern North America is presently unclear because of a lack of collections, *P. tuberculosa* is known to be widely distributed in northern boreal and arctic regions, with scattered occurrences at high elevations in the Appalachians (Hodkinson et al. in press; Plate 2).

Porpidia subsimplex (J. Lowe) Fryday – *Buck 53523, Buck 53504, Lendemer 11748, Lendemer 11749.*

Protothelenella corrosa (Körb.) H. Mayrhofer & Poelt† – *Buck 53522.*

This is a rare species of talus slopes and high humidity rocky habitats in North America. In eastern North America it is known from Newfoundland (Lendemer, unpublished data), Maine (Fryday 2006), New Hampshire, (Fryday unpublished data) with a questionable report from New Brunswick (Gowan & Brodo 1988; see Fryday 2006). The specimens reported here represents the southernmost known occurrence of the species in North America and the first report from Pennsylvania. Color illustrations of this species are provided here for the first time (Plate 3).

Pseudosagedia chlorotica (Ach.) Hafellner & Kalb – *Harris 54201.*

Psilolechia lucida (Ach.) M. Choisy – *Buck 53505, Harris 54192, Lendemer 11754.*

Punctelia rudecta (Ach.) Krog – *Lendemer 11710.*

Punctelia subrudecta auct. Amer. – *Lendemer 11702.*

Ramalina intermedia Nyl. – *Buck 53502, Lendemer 11713.*

Rhizocarpon rubescens Th. Fr. – *Lendemer 11709.*

Rhizocarpon subgeminatum Eitner ?† – *Lendemer 11697* (sterile).

The above collection is sterile and referred to *R. subgeminatum* on the basis of its thallus morphology and chemistry (an unidentified fatty acid). The distribution of this species is not well understood in North America, however it is known from high elevations and granitic balds in the southern Appalachians (Hodkinson et al. in press; Lendemer & Tripp 2008).

Rinodina tephraspis (Tuck.) Herre – *Buck 53518.*

Scoliciosporum pennsylvanicum R. C. Harris – *Buck 53517.*

This corticolous taxon, described elsewhere in this volume (Harris 2009), is known only from high humidity habitats in central Pennsylvania and southern New Jersey. Its known distribution at present almost certainly reflects our (WLB, RCH, and JCL) recent field activities.

Segestria lectissima Fr. – *Buck 53508, Harris 54200.*

Stereocaulon glaucescens Tuck.† – *Buck 53507, Edenborn s.n., Harris 54216, Harris 54221, Lendemer 11695, Lendemer 11706.*

Stereocaulon glaucescens is one of the dominant lichens at the Spruce Creek locality, easily recognized by its ligneous (basally brown-black) pseudopodetia. The species is common in New England (Hinds & Hinds 2008) and is known from scattered populations in the high elevations of the southern Appalachians (Hodkinson et al. in press.). This is the first report of the species from Pennsylvania.

Stereocaulon saxatile f. *paschaleoides* (Havaas) I.M. Lamb – *Harris 54217, Harris 54193, Lendemer 11716, Lendemer 11698.*

Careful examination of *Stereocaulon* thalli growing at the Spruce Creek locality revealed the presence of two seemingly distinct taxa. One of these represents *S. glaucescens* and the other represents a chemically similar but morphologically different species resembling *S. saxatile* in

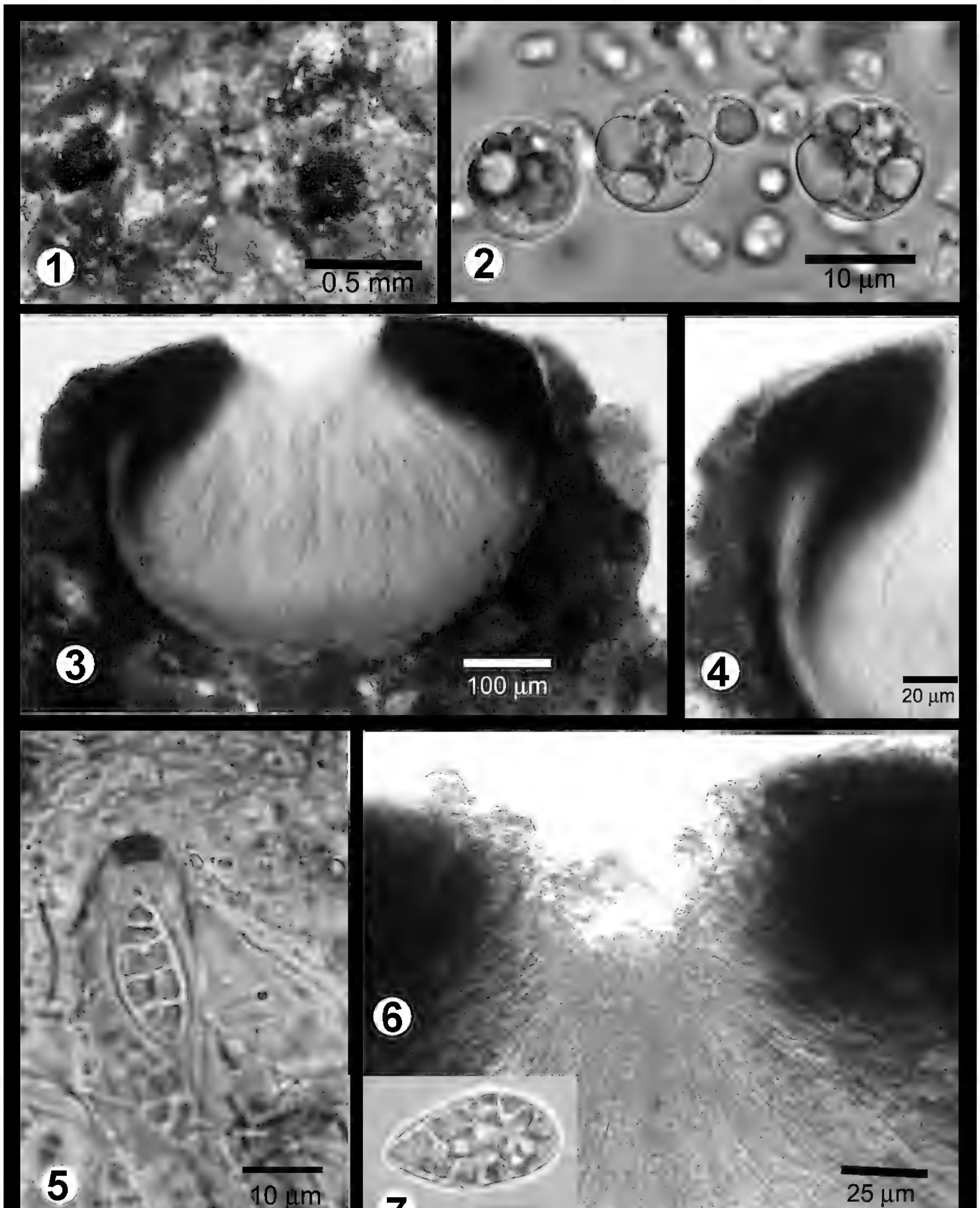

Plate 3. Figures 1-7. *Protothelenella corrosa* (all from *Buck 53522*, NY; except figure 5). Figure 1, habit. Figure 2, photobiont. Figure 3, ascoma (cross section). Figure 4, detail of exciple. Fig. 5, ascus in KI (*Nowak, Lich. Polon. Merid. Exs. 1*, NY). Figure 6, ostiolar region (periphyses absent). Figure 7, ascospore.

Plate 4. Illustration of the talus slope (top) and "ice caves" (bottom) discussed in this paper.

some respects, but differs in having a sparse pale tomentum and abundant cephalodia. We base our use of the name *S. saxatile* f. *paschaleoides* for this taxon on Lamb (1977).

Trapeliopsis viridescens (Schrad.) Coppins & P. James – *Lendemer 11720.*

Umbilicaria mammulata (Ach.) Tuck. – *Lendemer 11734.*

Umbilicaria muhlenbergii (Ach.) Tuck. – *Harris 54231, Lendemer 11700.*

Verrucaria phloeophila Breuss† – *Lendemer 11704.*

Breuss (2002) reported this corticolous species from North America based on collections from the Ozark Ecoregion. This is the first report of the species from Pennsylvania, and while the species may be rare, the scarcity of additional collections from eastern North America likely reflects collection bias against small crustose lichens.

Vulpicida pinastri (Scop.) J.E. Mattsson† – *Lendemer 11721, Lendemer 11726.*

Vulpicida pinastri is mapped by Brodo et al. (2001) as having a primarily northern distribution in eastern North America, extending southward in the Appalachian Mountains to Virginia and West Virginia. It is likely that this distribution is more realistic than that presented for other taxa with southern range extensions discussed here because *V. pinastri* is a brighly colored conspicuous species that is likely to be collected by even those unfamiliar with lichens. As we are unaware of a previous report of this taxon from Pennsylvania, we consider the present reports the first for this taxon from the state.

Xanthoparmelia conspersa (Ehrh. *ex* Ach.) Hale – *Buck 53510.*

Xanthoparmelia plittii (Gyeln.) Hale – *Harris 54212.*

Xanthoparmelia tasmanica (Hook. f. & Taylor) Hale – *Harris 54224.*

Xanthoparmelia viriduloumbrina (Gyeln.) Lendemer – *Harris 54204, Harris 54219, Lendemer 11714.*

General Discussion

As we have discussed in the introduction, "cold traps" are localities where the temperature is anomalously colder than the surrounding area during the warmer parts of the year. Although this phenomenon can be caused by any number of factors, many "cold traps" in Pennsylvania consist of talus slopes or boulder fields that are adjacent to, or overlay, a source of water such as a stream or spring. In the case of the locality that is the topic of this paper, the "cold trap" is an extensive north-facing talus slope directly adjacent to Spruce Creek, which runs along its base. Cool air regularly flows out from beneath the boulders at the base of talus slope, and ice persists in between the boulders well into the spring and early summer.

Although known anecdotally in lichenology, the occurrence of disjunct arctic or boreal taxa in "cold traps" does not appear to be well documented in the literature, and we are unaware of any publication dealing directly with the topic. With respect to North America, the phenomenon has been discussed by Dirig (1994). He considered the occurrence of disjunct arctic/boreal lichens in the Shawangunk Mountains of New York to represent Pleistocene relicts that had become "trapped in 'habitat islands' that approximate the more northern conditions they now optimally inhabit". We interpret the lichen biota of the Spruce Creek locality in a similar manner. Interestingly, while some of the lichens listed by Dirig (1994) as occurring in "cold traps" are shared with the locality we surveyed in Pennsylvania (e.g., *Arctoparmelia centrifuga*), a significant number of species are not. This may be due to the fact that the locality we surveyed was not glaciated during the last ice age (Sevon et al. 1999) and as such, it has likely been available for lichen colonization for a longer period than comparable localities in the Shawangunk Mountains.

Regardless of the origins of the lichen biota of the Spruce Creek Ice Caves, the assemblage of taxa is unique within the Commonwealth of Pennsylvania. Many of the species found at the locality are, in eastern North America, distributed primarily in the arctic-boreal region, with scattered populations at high elevations in the central and southern Appalachians (e.g., Brodo et al. 2001, Hinds & Hinds 2008, Plates 1–2). The populations of these taxa found at the Spruce Creek locality are thus disjunct in both space and elevation from their relatives. It is also important to note that the habitat occupied by some of these species at the Spruce Creek locality is significantly different from that which they occupy elsewhere in their ranges. For instance, *Cladonia stygia* is typically a species of open bogs in boreal regions, whereas at Spruce Creek it grows with other *Cladonia* species in crevices amongst boulders. Such shifts in the ecological niche occupied by a given taxon could be a successful survival strategy for persisting at a locality where

environmental factors, like temperature and humidity, remain ideal, after its preferred porophyte or ecological niche disappears.

Our study of the talus slope along Spruce Creek was initiated by the discovery of *Stereocaulon glaucescens*, a common species in boreal New England with rare disjunct populations at high elevations of the southern Appalachians (Hodkinson et al. in press). The subsequent survey of the locality revealed the presence of numerous additional disjuncts, including most notably: *Arctoparmelia centrifuga, Baeomyces carneus, Chrysothrix chlorina, Cladonia coccifera, C. floerkeana, C. stygia, Microcalicium arenarium, Porpidia tuberculosa, Protothelenella corrosa, Rhizocarpon subgeminatum,* and *Vulpicida pinastri*. All of these taxa are new reports for the Commonwealth of Pennsylvania. Several additional taxa are also new reports for the Commonwealth, but rather than representing disjunct populations, they are likely more widely distributed and have simply been overlooked and under-collected because of their small size. These taxa include *Opegrapha varia* and *Verrucaria phloeophila*. Further studies of the lichen biota of this locality, as well as those of other talus slopes and cold traps in the Commonwealth of Pennsylvania, will almost certainly result in the discovery of additional rare, endemic, and disjunct species. We believe that evaluation of these sites is an important step in documenting the biodiversity as well as the conservation needs of lichenized fungi in Pennsylvania.

Conservation Implications

The presence of so many disjunct species, clearly places the Spruce Creek Ice Caves among the most lichenologically significant sites in the Commonwealth of Pennsylvania. While the site is already protected as a Biological Diversity Area (BDA), the significant lichen occurrences indicate that a higher degree of protection may be necessary. Further, many of the disjunct lichens appear to occur as small populations or scattered individuals (*Stereocaulon glaucescens* is an exception). As such, the continued health of these populations may be highly sensitive to changes in the microclimate of the site, as well as human disturbance. While the latter may not greatly impact the locality at present, this could become a problem in the future as the nearby region is undergoing rapid residential and civil/infrastructural development. Future alteration of the climatic regime of the locality, including global climate change, could have a potentially harmful impact on the populations of rare and disjunct taxa, particularly lichenized fungi.

Acknowledgements

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Literature Cited

Balch, E.S. 1900. Glacières or freezing caverns. Allen, Lane, and Scott, Philadelphia, PA. 337 pp.

Breuss, O. 2002. Four *Verrucaria* species new to America. Evansia, 19(1): 26–28.

Brodo, I.M., S. Duran Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven & London. 795 pp.

Dirig, R. 1994. Lichens of Pine Barrens, Pine Plains, and "Ice Cave" habitats in the Shawangunk Mountains, New York. Mycotaxon, 52(2): 523–558.

Esslinger T.L. 2008. A cumulative checklist for the lichen–forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm (First Posted 1 December 1997, Most Recent Update 18 January 2008), Fargo, North Dakota.

Fryday, A.M. 2006. New and interesting North American lichen records from the alpine and sub–alpine zones of Mt. Katahdin, Maine. The Bryologist, 109(4): 570–578.

Gowan, S.P. and I.M. Brodo. 1988. The lichens of Fundy National Park, New Brunswick, Canada. The Bryologist, 91: 255–325.

Hale, M.E. 1987. A monograph of the lichen genus *Parmelia* Acharius sensu stricto (Asocmycotina: Parmeliaceae). Smithsonian Contributions to Botany, 66: 1–55.
Harris, R.C. 2009. Four novel lichen taxa in the lichen biota of eastern North America. Opuscula Philolichenum, 6 149-156.
Harris, R.C. and D. Ladd. 2008. The lichen genus *Chrysothrix* in the Ozark Ecoregion, including a preliminary treatment for eastern and central North America. Opuscula Philolichenum, 5: 29–42.
Harris, S.A. and D.E. Pedersen. 1998. Thermal regimes beneath coarse blocky materials. Permafrost and Periglacial Processes, 9:107–120.
Hinds, J.W., and P.L. Hinds. 2008. The Macrolichens of New England. Memoirs of the New York Botanical Garden, 96: 1–584.
Hodkinson, B., R.C. Harris, and M.A. Case. In press. A checklist of Virginia lichens. Evansia.
Lamb, I.M. 1977. A conspectus of the lichen genus *Stereocaulon* (Schreb.) Hoffm. Journal of the Hattori Botanical Laboratory, 43: 191–355.
Lendemer, J.C. and E.A. Tripp. 2008. Contributions to the Lichen Flora of North Carolina: A Preliminary Checklist of the Lichens of Gorges State Park. The Bryologist, 111(1): 4–67.
Sevon, W.D., G.M. Fleeger, and V.C. Shepps. 1999. Pennsylvania and the Ice Age (2nd ed.). Pennsylvania Geological Survey, 4th ser., Educational Series 6, 30 pp.
Western Pennsylvania Conservancy. 2004. Huntingdon County Natural Heritage Inventory. 202 pp.

Opuscula Philolichenum, **6**: 137–148. 2009.

Observations on the genus *Neolamya*, with the description of the new species *N. xanthoparmeliae* (Ascomycota, genera incertae sedis)

Jana Kocourková[1]

ABSTRACT. – A new species, *Neolamya xanthoparmeliae,* is described on *Xanthoparmelia* species from the Czech Republic and also reported from North America in California. The genus *Neolamya* is discussed and *N. xanthoparmeliae* is compared with *Neolamya peltigerae*. *Acremonium rhabdosporum* is reported as new for the Czech Republic. *Arthonia xanthoparmeliarum* is reported as new for North America from California.

KEYWORDS. – Clypeus, ecology, lichenicolous fungi, Montagne, systematics, taxonomy, unitunicate asci, *Weddellomyces xanthoparmeliae.*

Introduction

During my surveys of lichenicolous fungi in the Czech Republic and in California I have found an undescribed fungus on *Xanthoparmelia* species which fits well in the monotypic genus Neolamya (Mont.) Theiss & Syd. This species is described below as *Neolamya xanthoparmeliae*.

The generic name *Neolamya* was introduced by Theissen & Sydow (1918) to accommodate the only species *Neolamya peltigerae* (Mont.) Theiss. & Syd. The basionym was *Sphaeria peltigerae* Mont. (Montagne 1845). It was later treated as *Rhaphidophora peltigerae* (Mont.) Mont. (Montagne 1856). Caresti and De Notaris (De Notaris 1867) re-described the fungus as *Rhaphidophora thallicola* Car. & De Not. Saccardo (1883) made two new combinations *Ophiobolus peltigerae* (Mont.) Sacc. and *Ophiobolus thallicola* (Car. & De Not.) Sacc. Arnold (1878) re-described the species as *Leptosphaeria peltigerarum* Arn. and based on his species two new combinations were made: *Ophiobolus peltigerarum* (Arn.) Berl. & Voglino (Saccardo 1891) and *Metasphaeria peltigerarum* (Arn.) Mig. (Migula 1913).

When it became clear that the fungus did not match any of these genera, a new genus *Lamyella* Berl. (Berlese 1899) was proposed for this fungus. However, the genus name *Lamyella* had to be replaced with the new generic name *Neolamya* because the older genus *Lamyella* Fries (Fries 1849) was already proposed for imperfect fungus (Keissler 1930).

According to the type diagnosis (Montagne 1845), *Neolamya peltigerae* is characterized by small, erumpent, sparse, immersed, globose to ovate, black perithecia, spliting the host thallus radially like a star, and acicular ascospores.

All the genera to which *Neolamya peltigerae* has previously been assigned, except those of Arnold (1878) and Kalb et al. (1995), are perithecioid with bitunicate or fissituicate asci. Arnold (1878) thought *Neolamya peltigerae* possesed apothecia but tentatively placed it in *Leptosphaeria* Ces. & De Not. (Cesati & De Notaris 1863), a genus of perithecial fungi with yellow ascospores. Kalb et al. (1995) speculated that *Neolamya peltigerae* could be apothecioid, a relative of the black, lichenized genus *Ramonia* Stizenb., which according to the current Outline of Ascomycota (Lumbsh & Huhndorf 2007) belongs to the family Gyalectaceae (A. Massal.) Stizenb. It is evident that these authors saw only periphyses in ostiolar area and did not note the periphysoids on the upper wall of ascoma (see Plate 1, Fig. 5).

Ertz (2004) gave the most complete description of *Neolamya peltigerae*. He characterized the fungus by spherical to ovoid perithecioid ascomata without involucrellum, with ascoma wall dark brown, of conglutinated hyphae, hymenium of simple paraphyses not apically enlarged, periphyses simple; asci

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cylindrical to clavate, unitunicate, not apically thickened, without a distinct ocular chamber, 16–32-spored, 90–110 x 15–22 µm, without any amyloid reaction (I– and K/I–); ascospores hyaline, filiform, 3–septate, with oil drops, straight or slightly curved, 40–86 × 2–4 µm; conidiomata pycnidia, spherical, with brown wall, darker around ostiolum, conidia hyaline, simple, bacilliform.

During this study I found several differences with Ertz's description (2004) including the additional important characters of a clypeus, simple or sparsely branched and only occasionally septate external and internal periphyses, periphysoids, internal hyaline ascoma wall and dehiscence of ascospores by gelatinizing ascus wall. The detailed description is given below at the species.

These characters can be helpful in finding the best systematic position of the genus *Neolamya* among the genera with perithecial ascomata, where the stroma is present only as a clypeus, and with unitunicate asci, hyaline filiform ascospores, unbranching paraphyses not becoming gelatinized and no amyloid reaction. The genus *Neolamya* is currently placed in Sordariomycetes, genera incertae sedis (Eriksson & Hawksworth 1993, Lumbsh & Huhndorf 2007). However, according to my current knowledge it really seems that it does not belong to any of known orders and families of Sordariomycetes. Based on the combination of characters *Neolamya* probably belongs in a new family. However, the problem needs more detailed study.

Materials and Methods

All material of *Neolamya peltigerae* and *N. xanthoparmeliae* used for this study was collected by the author and is preserved in the herbarium PRM.

Specimens have been examined using standard microscopical techniques. Hand made sections and thin sections made on Leica CM1850 cryostat were studied in water and Bcr (used only as a stain), all measurements were done in water. Amyloid reactions were tested in Lugol's iodine [I] with and without pretreatment with 10 % KOH [K/I]. Asci and ascospore measurements were made with accuracy of 0.5 µm and given in the form "(minimum–) mean minus standard deviation – *mean* – mean plus standard deviation (–maximum)" and followed by the number of measurements (n); the length/breadth ratio of ascus and ascospore is indicated as l/b and given in the same way.

Macro and microphotographs were taken with an Olympus C5050 digital camera on Olympus SZX 9 Stereomicroscope and Olympus BX 50 microscope (to 1250x) fitted with Nomarski differential interference contrast.

Taxonomic Section

Neolamya Theiss. & Syd., Ann. Mycol. 16: 29. 1918.

Typus generis: *N. peltigerae* (Mont.) Theiss. & Syd. (Basionym: *Sphaeria peltigerae* Mont.)

Substitute name for *Lamyella* Berl.1899 non E.M. Fries 1849.

Lamyella Berl., Icon. Fungorum 2: 139. 1899 (non E.M. Fries 1849).

Typus generis: *L. peltigerae* (Mont.) Berl. (Basionym: *Sphaeria peltigerae* Mont.) ≡ *Neolamya* Theiss. & Syd.

1. ***Neolamya peltigerae*** (Mont.) Theiss. & Syd., Ann. Mycol. 16, 1918.

Plates 1 & 2 (pages 139 & 140).

Sphaeria peltigerae Mont., Annal. sc. nat., Bot., sér. III, T. IV, p. 362, 1845. Type: FRANCE: Aix, prope Lemovicem, in pagina superiori *Peltigerae horizontalis*, leg. Lamy. (not seen)
= *Rhaphidophora peltigerae* (Mont). Mont., Syll. Crypt., Paris, p. 252, 1856.
= *Ophiobolus peltigerae* (Mont.) Sacc., Syll. fung. (Abellini) 2: 351, 1883.
= *Lamyella peltigerae* (Mont.) Berl., Icon. Fungorum 2: 139, 1899 (non E.M. Fries 1849).

Leptosophaeria peltigerarum Arn., Verh. zool.-bot. Ges., Wien, Bd. 28, p. 271, 1878. Type: AUSTRIA: Tirol, Möserlingwand bei Windisch-Matrei, supra *Peltigera aphtosa*, leg. Arnold. (not seen)
= *Ophiobolus peltigerarum* (Arn.) Berl. & Voglino, in Sacc. Syll. fung. vol. IX., p. 933, 1891.
= *Metasphaeria peltigerarum* (Arn.) Mig., Krypt.-Fl. v deutsch., Bd. III, 3. Abt., 1 T., p. 405, 1913.

Rhaphidophora thallicola Car. & De Not., in De Not. Comment. Soc. Crittol. Ital., p. 489, 1867. Type: ITALY: Schönine supra Allagna, Valsesia, Ital. bor. leg. Carestia. (not seen)
= *Ophiobolus thallicola* (Car. & De Not.) Sacc., Syll. fung. (Abellini) 2: 351, 1883.

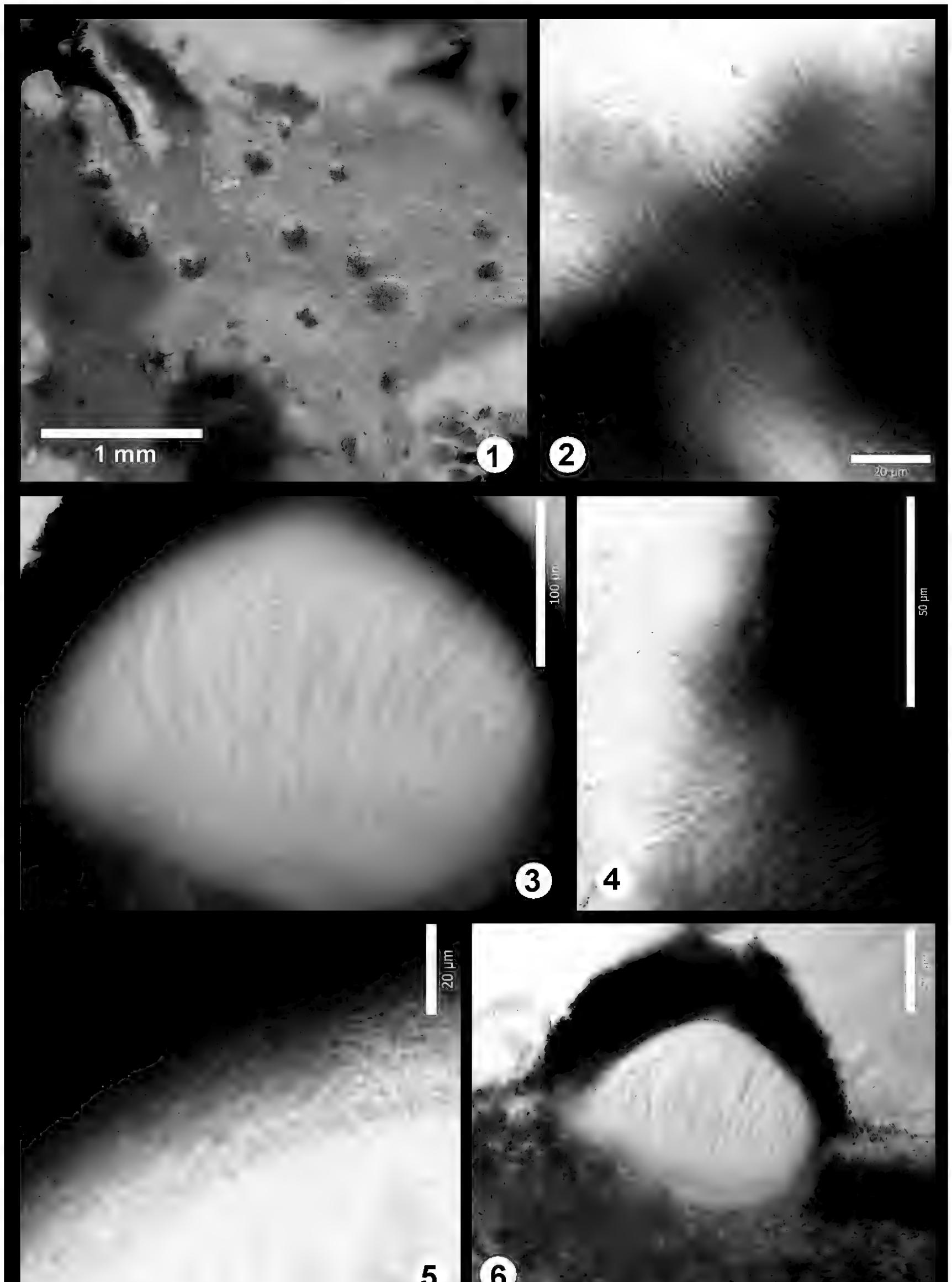

Plate 1. *Neolamya peltigerae* (all from PRM 915430; figures 2-6 in water). Figure 1, infection on the host thallus (scale = 1 mm). Figure 2, ostiolum with external periphyses (scale = 20 µm). Figure 3, ascoma cavity (scale = 100 µm). Figure 4, internal periphyses (scale = 50 µm). Figure 5, periphysoides (scale = 20 µm). Figure 6, section of ascoma (scale = 50 µm).

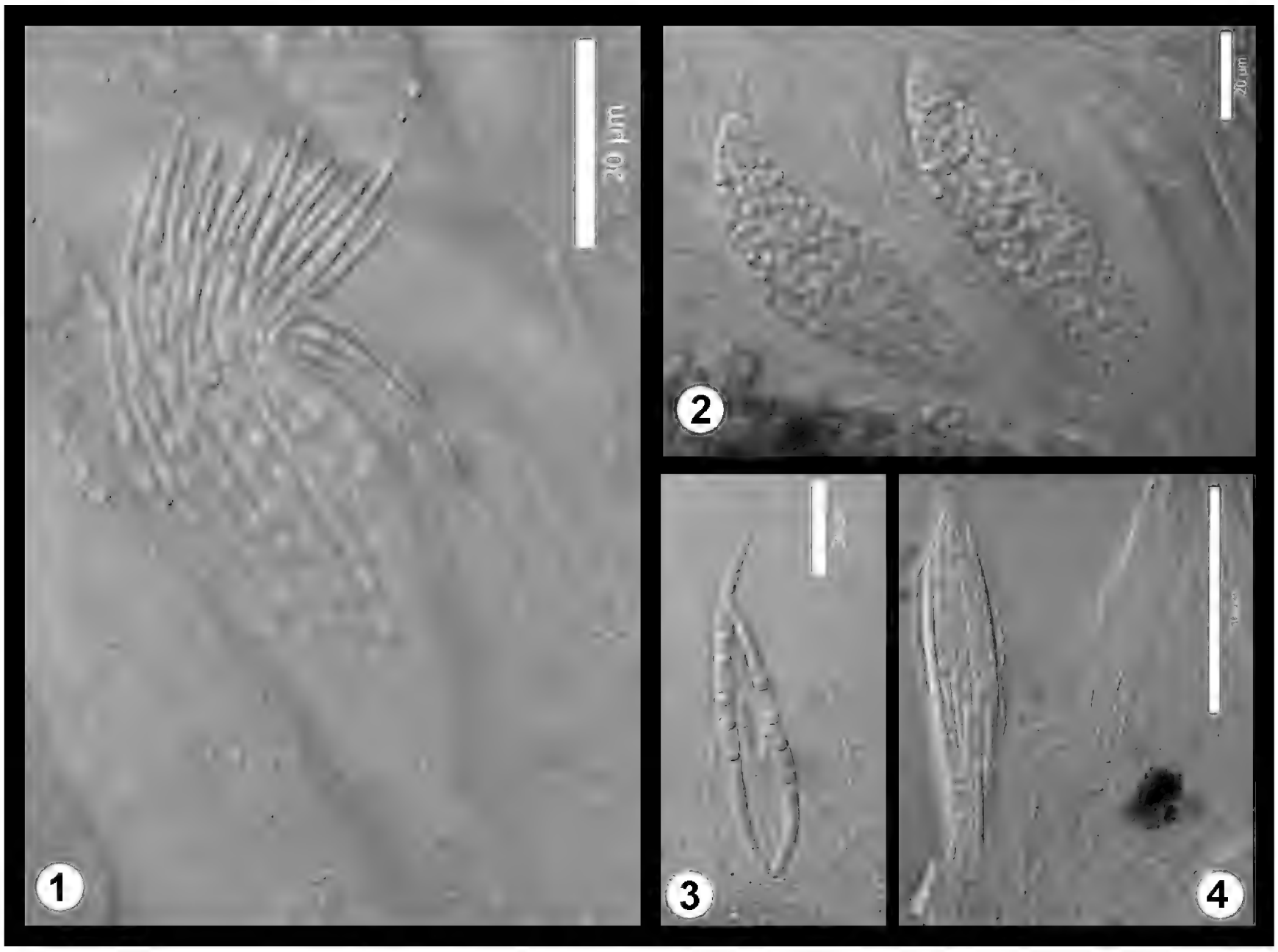

Plate 2. *Neolamya peltigerae* (all from PRM 915430; all figures in water). Figure 1, 24–spored ascus (scale = 20 µm). Figure 2, asci and simple paraphyses (scale = 20 µm). Figure 3, mature ascospores (scale = 20 µm). Figure 4, gelatinized wall of ascus (scale = 50 µm).

Description. – Fungus lichenicolous on *Peltigera* species. Ascomata perithecial, single, dispersed on the host thallus (see Pl. 1, Fig. 1), globose to widely pyriform (Pl. 1, Fig. 3, 6), black, almost immersed or with 1/3 erupmpent, splitting the host thallus radially like a star, with thin clypeus, ostiolate, (180–)200–325 × (200–)230–370 µm in diam.; ascoma wall dark brown around ostiolar part, paler brown below, internal wall yellowish or almost hyaline, 10–15 µm, plectenchymatous of conglutinated hyphae. Hymenium of septate paraphyses longer than asci, not thickened at apices and embedded in gel matrix, 1.5–2.0 µm wide, external periphyses (sensu Roux & Triebel 1994) golden brown, simple, 25–45 µm long, 1.5–2.0 µm wide, internal periphyses in ostiolar canal, hyaline, simple or forked above, 12–25 µm long, 1.5–2.0 µm wide, periphysoids simple, hyaline, 10–25 µm long, 1.0–1.5 µm wide. Asci unitunicate, 16–24–32-spored (Pl. 2, Fig. 1), cylindrical to clavate, (77.5–)93.5–*106.5*–119.5(–120.0) × (16.0–)18.0–*21.0*–24.0(–27.0) µm l/b (4.0–)4.2–*5.2*–6.0(–7.5) (n=11), I–, K/I–. Ascospores hyaline, filiform to long fusiform, usually somewhat curved, 3–6 septate, when mature with two big guttules in every cell, (56.0–)65.0–*73.0*–81.0(–90.0) × (2.0–)2.5–*2.9*–3.0(–3.5) µm, l/b (18.3–)22.5–*27.2*–31.9(–36) (n=28). Conidiomata pycnidia, immersed, 20–50 µm in diam., spherical, with brown wall, darker around ostiolum, conidiogenous cells ampulliform, conidia hyaline, simple, bacilliform, 3.5–4.5 × 1.0–1.5 µm.

Ecology. – The fungus was found on several host species of *Peltigera* Willd. including *P. aphtosa* (L.) Willd., *P. horizontalis* (Huds.) Baumg., *P. praetextata* (Flörke ex Sommerf.) Zopf but mostly on *P. didactyla* (With.) J. R. Laundon. It appears to be commensalistic.

Distribution (only first country report is given). – Europe: France (Montagne 1845), Italy (De Notaris 1867), Austria (Arnold 1878), Great Britain (Olivier 1907), Hungary (Kofarago-Gyelnik 1940), Sweden

and Norway (Erichsson 1992, Kümmerlin & Alstrup 1992), Luxembourg (Sérusiaux et al. 2003), Russia - European part (Zhurbenko 2004); Asia: Russia (Zhurbenko & Hafellner 1999), and from North America in Canada: British Columbia (Alstrup & Cole 1998), the U.S.A.: Arizona (Aptroot et al. 1997); and from Greenland (Kümmerling & Alstrup 1992).

It is a holoarctic species. In central Europe it is found mostly in the mountains.

DISCUSSION. – According to Aptroot et al. (1997) *N. peltigerae* occurs on *Polychidium muscicola* (Sw.) Gray and *P. stipitatum* Vězda & Weber in Papua New Guinea. The genus *Polychidium* (Ach.) Gray belongs to the same order Peltigerales as *Peltigera*. However, the fungus on *Polychidium* is probably an undescribed species with much smaller ascomata but the material is too poor and it is necessary to wait for additional collections, for more detailed study (Diederich, pers. comm.). The authors did not mention if they saw periphyses and periphysoids and if paraphyses were branching or unbranching, which are important features for genus placement.

SPECIMEN EXAMINED. – **GREENLAND.:** Narsarsuaq, Blomsterdalen to glacier, 1 m, 61°11'53.1"N, 45°19'55.8"W, on granitic alluvial deposits, on consolidated soil, on *Peltigera didactyla*, 24.vii.2005, *J. Kocourková* (PRM 915430).

2. *Neolamya xanthoparmeliae* Kocourk. sp. nov.

MYCOBANK #513024.

PLATES 3 & 4 (PAGES 143 & 144).

Fungus lichenicola in thallis lichenis *Xanthoparmelia* species vigens. Similis *Neolamyae peltigerae* sed differt ascomatibus globosis, ascis usque 16-sporis, ascosporis brevioribus, (55.0–)60.0–*75.1*–90.0(–111.5) × (3.0–)3.5–*4.2*–4.75(–5.0) µm et conidiomatibus majoribus, 80–100 µm diam., cum conidiis cylindricis, 3–3.5(–4) × 2 µm diam.

TYPE: **CZECH REPUBLIC.:** Central Bohemia, Distr. Rakovník, between villages of Roztoky and Karlova Ves, valley of Klucná brook, on west-facing slope of Baraník hill, 360 m, 50°0'19.149"N 13°51'58.282"E, on *Xanthoparmelia conspersa*, on ryolite rock, 16.x.1998, *J. Kocourková* (PRM 842980, holotype; hb. Diederich, isotype).

DESCRIPTION. – Fungus lichenicolous on *Xanthoparmelia* species forming pale brown or pale orange necrotic patches usually near the margin of lobes. Ascomata perithecioid, globose, black, only slightly erumpent, breaking through the host thallus, occasionally occurring inside of isidia which become swollen, single or in groups of two, covered by thin clypeus, ostiolate, (180–)250–350 × (195–)240–290 µm in diam., 45–55 µm thick in upper part, wall of ascoma plectenchymatous, not sharply delimited from the host thallus, 15–20 µm thick, clypeus dark brown, together with ascoma wall up to 35 µm thick; lower ascoma wall brown, 8–12 µm thick, internal wall hyaline, 7–15 µm thick, below ostiolar part thicker, up to 20 µm. Hymenium of paraphyses longer than asci, not thickened at apices, septate, cells 12–19 µm long; external periphyses brown, cylindrical, aseptate, not branched, 15–25 × 1.5–2 µm, internal periphyses (in lower part of ostiolar channel) hyaline, cylindrical, aseptate to 2–septate, simple or occasionally branched, 20–35 × 1.5–2 µm, periphysoids thin, simple, 1–2 septate, 7–15 × 1.0–1.5 µm. Asci clavate to cylindrical, unitunicate, thin-walled, thickened at apex only when young, 15 to 60 per ascoma, constantly 16–spored, with ascospores arranged in two bundles of 8 interlocking ascospores in upper and lower part of ascus (Pl. 4, fig. 4), dehiscence of ascus starts with gelatinizing of the upper or lower part of ascoma near foot, with ascospores remaining for some time fixed together in gelatinous matrix, (67.5–)98.0–*118.0*–137.5(–140.0) x (13.0–)15.0–*17.75*–20.5(–23.0) µm, l/b (4.7–)5.8–*6.7*–7.5(–8.4) (n=20), I–, K/I–. Ascospores hyaline, filiform to long fusiform, usually somewhat curved, 3 to 10-septate, at septa slightly constricted in mature ascospores, the most at median septum, cells with oil drops, (55.0–)60.0–*75.1*–90.0(–111.5) × (3.0–)3.5–*4.2*–4.75(–5.0) µm, l/b (12.2–)18.8–*18.1*–21.4(–24.3) (n=30). Conidiomata pycnidia, sphaerical with slightly prolongated ostiolar part, erumpent, to half immersed, 65–90 µm in diam., dark brown around ostiolum, paler below, wall of isodiametric cells, conidiogenous cells ampuliform, (4)–6–8(–10) × 2–3 µm, conidia simple, hyaline, cylindrical to narrowly ovoid, at base shortly stipitate, 3–3.5(–4) × 2 µm in diam. (Pl. 4, Figs 1 & 2).

Pycnidia were present only on *Xanthoparmelia verruculifera* (Nyl.) O. Blanco et al., the brown *Xanthoparmelia*. In several specimens that were rich with pycnidia, the production of ascomata was suppressed (PRM 909655, 907522, 907524).

Ecology. – *Neolamya xanthoparmeliae* occurs on *Xanthoparmelia conspersa* (Ehrh. *ex* Ach.) Hale, *Xanthoparmelia sp.*, and *X. verruculifera* in the Czech Republic, and was observed on *X. mexicana* (Gyelnik) Hale in North America. It is a saproparasitic species.

The fungus is commonly found in mixed infections with other lichenicolous fungi, e.g. *Lichenostigma cosmopolites* Hafellner & Calatayud, *Stigmidium xanthoparmeliarum* Hafellner, *Lichenoconium usneae* (Anzi) D. Hawksw., *Nesolechia oxyspora* (Tul.) A. Massal. and several currently undescribed lichenicolous fungi.

The type locality of *Neolamya xanthoparmeliae* was very rich in lichenicolous fungi on *Xanthoparmelia* species. *Abrothallus caerulescens* Kotte on *X. conspersa* (PRM 892468, 915428); *Acremonium rhabdosporum* W. Gams – on *X. conspersa* (PRM 915436), new to the Czech Republic!; *Cornutispora lichenicola* D. Hawksw. & B. Sutton – on *X. conspersa* (PRM 915457); *Lichenoconium erodens* M.S. Christ. & D. Hawksw. – on *X. conspersa* (PRM 906652, on thallus); *Lichenoconium usneae* – on *X. conspersa* (PRM 915450, on apothecia); *Lichenostigma cosmopolites* – on *X. conspersa* (PRM 892547, 915449); *Nesolechia oxyspora* – on *X. conspersa* (PRM 758277); *Phoma* sp. – on *X. protomatrae* (Gyeln.) Hale (PRM 908161); *Sclerococcum* sp. – on *X. conspersa* (PRM 758324), which differs from *Sclerococcum parmeliae* Etayo & Diederich and *S. serusiauxii* Boqueras & Diederich in having aeruginose sporodochia and conidia, and growth on saxicolous lichens (Kocourková 2000); *Stigmidium neofusceliae* Calatayud & Triebel – on *X. verruculifera* (PRM 907874); *Vouauxiomyces*, anamorph of *Abrothallus caerulescens* – on *X. stenophylla* (Ach.) Ahti & D. Hawksw. (PRM 906649) and on *X. conspersa* (PRM 915437).

In other Czech localities, *Neolamya xanthoparmeliae* was found also with *Stigmidium xanthoparmeliarum* Hafellner and commonly with *Weddellomyces xanthoparmeliae* Calat. & Nav.-Ros. In the Californian locality it was found in mixed infection with *Arthonia xanthoparmeliarum* Etayo (new for North America!), *L. cosmopolites*, *Nesolechia oxyspora*, *S. xanthoparmeliarum,* and *Weddellomyces xanthoparmeliae*. The last two species were recently reported as new to North America by Kocourková & Knudsen (2008).

Distribution. – The species is currently known from Europe in the Czech Republic and from an unpublished record in Austria (Berger, pers. comm.) and North America in California. In Europe it was found from lowlands to highlands, the southern California locality is in the mountains.

Discussion. – *Neolamya xanthoparmeliae* is well distinguished from *N. peltigerae* in being saproparasitic on *Xanthoparmelia* species, ascomata spherical versus pyriform, constantly 16-spored asci versus asci 16–32-spored, wider ascospores (55.0–)60.0–*75.1*–90.0(–111.5) × (3.0–)3.5–4.2–4.75(–5.0) µm versus (56.0–)65.0–*73.0*–81.0(–90.0) × (2.0–)2.5–*2.9*–3.0(–3.5) µm, large pycnidia 80–100 µm versus 20–50 µm and cylindrical conidia 3.0–3.5 × 2.0 µm in diam. versus bacilliform conidia 3.5–4.5 × 1.0–1.5 µm.

Neolamya xanthoparmeliae bleaches the host thallus forming pale brown or pale orange necrotic patches usually near the margin of lobes. I have occasionally seen young ascomata in still living parts of thalli but they are immersed and no symptoms of infection are visible. I have never seen mature ascospores in them. Mature ascospores were only present in ascomata occurring in the most necrotic parts of the thallus. The necrotic tissue eventually becomes brittle and fragments with mature ascomata.

The type and color of infection and life cycle of the fungus seems to be very similar to the lichenicolous fungus *Weddellomyces xanthoparmeliae* (Kocourková 1999). Both fungi occur on *Xanthoparmelia* species, both fungi are saproparasites. The host thallus covering the ascoma in *Weddellomyces* infection is ochraceous to pale orange and splits in three or four cracks but in *Neolamya* soon turns grey and splits radially like a star. When wet, the ascomata of *Neolamya* remain black; the ascomata of *Weddellomyces* become dark reddish brown.

Both fungi seem to share the same ecological demands and colonize the same range of hosts. Both fungi occur on *Xanthoparmelia* hosts and both colonize also *Xanthoparmelia* subg. *Neofuscelia*, which supports the placement *Neofuscelia* in *Xanthoparmelia* and co-evolutionary theory of the common development of fungus with its host.

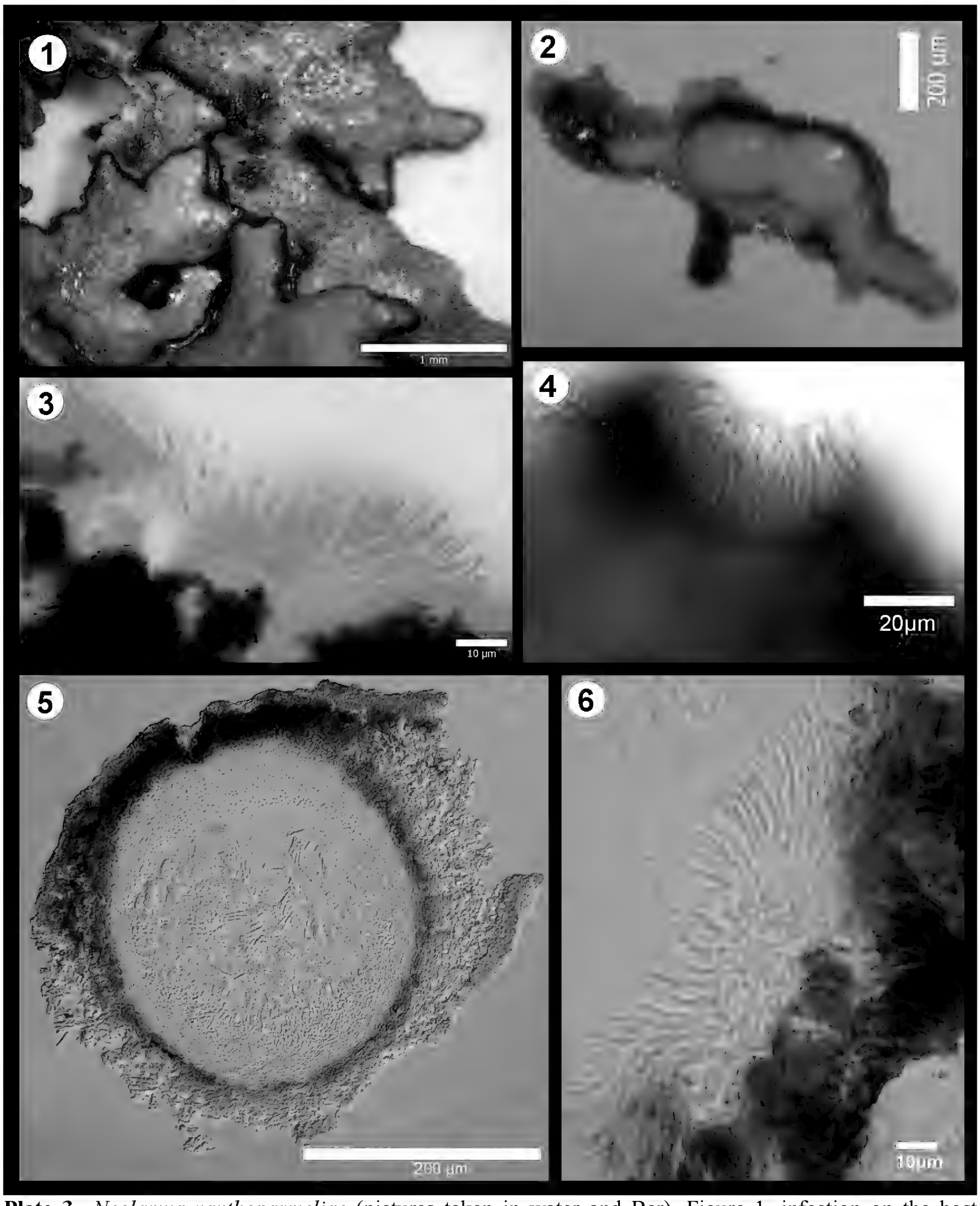

Plate 3. *Neolamya xanthoparmeliae* (pictures taken in water and Bcr). Figure 1, infection on the host thallus (holotype; scale = 1mm). Figure 2, section of the thallus with two ascomata covered with clypeus (PRM 915458; scale = 200 µm). Figure 3, branching, septate internal periphyses (PRM 915458; scale = 10 µm). Figure 4, external periphyses (PRM 915458; scale = 20 µm). Figure 5, section of ascoma (holotype; scale = 200 µm). Figure 6, branching, septate internal periphyses (PRM 915458; scale = 10 µm).

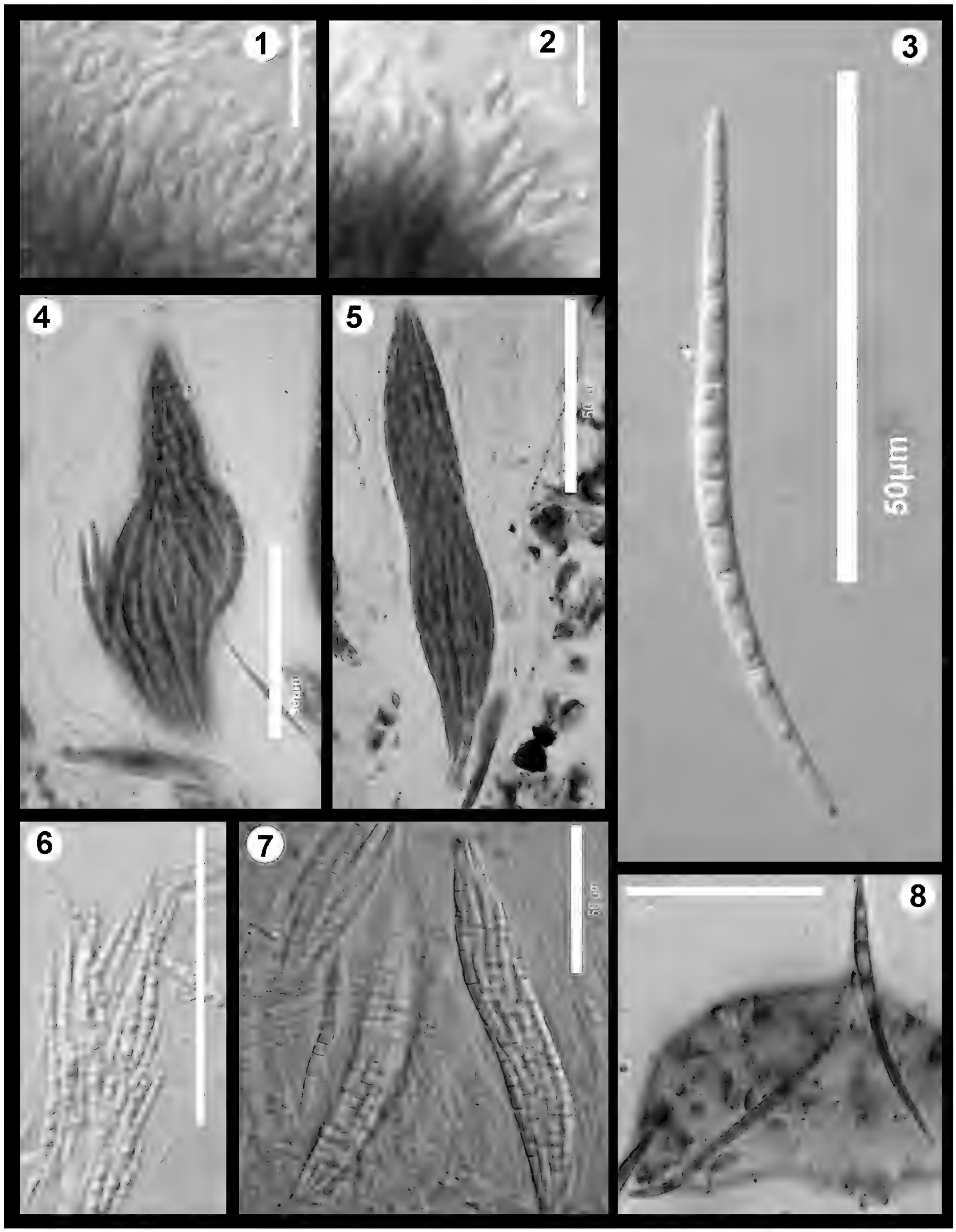

Plate 4. *Neolamya xanthoparmeliae.* Figues 1 & 2, conidiogenous cells and conidia (PRM 909655; scale = 10 µm). Figure 3, nearly mature ascospore (holotype; scale = 50 µm). Figure 4, two bundles of 8 ascospores in Bcr (PRM 915458; scale = 50 µm). Figure 5, mature ascus in Bcr (PRM 915458; scale = 50 µm). Figure 6, released conidia from ascus (holotype; scale = 50 µm). Figure 7, mature asci (PRM 915458; scale = 50 µm). Figure 8, mature ascospores in Bcr (PRM 915458; scale = 50 µm).

According to observations made in central Europe, both fungi are found mature in autumn but the life cycle seems to be somewhat longer for *Neolamya* which is found mature in late autumn, in October and November. It means the new infection starts to develop or old infection enlarges the necrotic lesion on the host thallus in spring and the fungus become mature in autumn. During winter the necrotic tissue fragments and disintegrates and in spring the infection spreads to a new area on thallus of the host. I have never found mature ascomata in spring or early summer.

Comparing frequency and distribution of both fungi, *Neolamya xanthoparmeliae* is a rarer species than *Weddellomyces xanthoparmeliae* (currently known in the Czech Republic from about 25 localities). Possibly *N. xanthoparmeliae* is really not so rare but is less conspicuous in the field and easily damaged in collections because of fragmentation, so it can be easily overlooked. *Weddellomyces xanthoparmeliae* is found in mixed infections with the same lichenicolous fungi as *N. xanthoparmeliae* (see above); however, they have never been seen in common infection mixed together.

Additional Specimens examined (Paratypes) – **Czech Republic. Central Bohemia.** the city of Praha: Dolní Liboc, Divoká Šárka nature reserve, Dívčí skok hill, MTB 5851 D, ca 300 m, on steep rocky slope on lydite, on *Xanthoparmelia conspersa*, 27.xi.1998, *J. Kocourková* (PRM 915458); Dolní Liboc, Divoká Šárka nature reserve, in glen below Kozákova and Šestákova rocks, MTB 5851 D, 50°5'42"N 14°19'13.03"E, 290 m, on lydite outcrop, on *Xanthoparmelia sp.*, 9.xi.2003, *J. Kocourková* (PRM 908163); Divoká Šárka nature reserve, Čertův mlýn, MTB 5851 D, 50°6'5.2"N 14°19'37.6"E, 320 m, on *X. conspersa*, in scree, on lydite boulder, 6.x.2005, *J. Kocourková* (PRM 907279); Suchdol, Sedlecké rocks protected area, Vyhlídka rock, MTB 5852 C, 50°8'7.6"N 14°23'18.5"E, 270 m, outcrop exposed to S, on Proterozoic shale, on *X. conspersa,* 2.x.2002, *J. Kocourková* (PRM 907491, PRM 907495, PRM 907496); Sedlecké rocks protected area, on uppermost Vltava River terrace exposed to SEE, MTB 5852 C, 50°8'21.6"N 14°23'32.3"E, 270 m, on *X. verruculifera*, on proterozoic shale, 13.x.2002, *J. Kocourková* (PRM 907522-with pycnidia, PRM 907523, PRM 907524-only pycnidia, 907525); Sedlecké rocks protected area, MTB 5852 C, 50°8'20.4"N 14°23'31.3"E, 270 m, outcrops above Vltava River exposed to SEE, on rock exposed to S, on *X. verruculifera*, 13.x.2002, *J. Kocourková* (PRM 909655, only pycnidia); Landscape protected area Křivoklátsko, 1 km SSE of the village Kublov, at road cross at former mill U Křížků, MTB 6049 C08, 49°56'3.04"N 13°51'58.28"E, 395 m, on quartzite boulder in meadow near Kublovský potok stream, on *X. conspersa*, 6.vii.1998, *J. Kocourková* (PRM 758273, together with *Lichenostigma elongatum* and *Sclerococcum parmeliae*); Distr. Rakovník, between villages of Roztoky and Karlova Ves, valley of Klucná brook, on west-facing slope of Baraník hill, MTB 5949 C18, 50°0'19.149"N, 13°51'58.282"E, 360 m, on *X. conspersa*, on ryolite rock, 16.x.1998, *J. Kocourková* (PRM 909676); Distr. Mělník, Minice at Kralupy nad Vltavou, Minická skála nature monument, 50°13'6.9"N 14°17'14.7"E, 240 m, on *X. verruculifera*, on top of S-facing spilite rocks, 25.x.2008, *J. Kocourková* (PRM 915112); **Western Moravia:** Distr. Třebíč: near the confluence of the rivers Chvojnice and Oslava, below the castle Ketkovický hrad, on the NE exposed slope with boulder scree, MTB 6863 C, 49°8'22.429"N, 16°14'18.519"E, 360 m, on granulite boulder, on *X. conspersa,* 5.x.1998, *J. Kocourková* (PRM 758316). **Southern Moravia:** Distr. Znojmo: National Park Podyjí, Býčí skála rock, MTB 7161 D, 48°50'26.511"N, 15°59'40.423"E, 310 m, on granite rocks, on *X. conspersa,* 5.vi.1998, *J. Kocourková* (PRM 892650). **U.S.A. California.** Riverside Co.: near Sugarloaf Mountain, 1219 m, 33°35'2"N 116°26'13"W, on *X. mexicana*, Pinyon pines, yucca, on crumbling granite boulder, 16.iv.2007, *J. Kocourková & K. Knudsen* (material spent with examination).

New Reports

1. *Acremonium rhabdosporum* W. Gams

Note. – New to the Czech Republic.

Specimen examined. – **Czech Republic**: **Central Bohemia.** Distr. Rakovník, between villages of Roztoky and Karlova Ves, valley of Klucná brook, on west-facing slope of Baraník hill, 360 m, 50°0'19.149"N 13°51'58.282"E, on *Xanthoparmelia conspersa*, on ryolite rock, 16.x.1998, *J. Kocourková* (PRM 915436).

2. *Arthonia xanthoparmeliarum* Etayo

Notes. – While searching for *Neolamya* on *Xanthoparmelia* in California with Kerry Knudsen, we found an *Arthonia* which was recently described from South America in Chile (Etayo & Sancho 2008). The species is new for North America.

Specimens examined (all on *Xanthoparmelia mexicana*). – **U.S.A. California**. Riverside Co.: near Sugarloaf Mountain, 1219 m, 33°35'2"N 116°26'13"W, on crumbling granite boulder, 16.iv. 2007, *J. Kocourková & K. Knudsen* (PRM

909660); *Ibidem*, 23.vii.2007, *J. Kocourková & K. Knudsen* (PRM 909669, PRM 915443, UCR). — Santa Barbara County, Santa Rosa Island: Quemada Canyon: rock outcrop near road, 45 m, 33°58'33"N, 120°0'55"W, 19.vii.2007, *J. Kocourková & K. Knudsen* (PRM 915444). VENTURA CO.: Santa Monica Mountains, Thousand Oaks, Westlake village, near lake Elenor Dam, near Highway 23 South, 291 m, 34°8'12"N 118°51'7"W, on rocky slope above highway, scattered chaparral, on volcanic rocks, 24.xi.2008, *J. Kocourková, K. Knudsen & T. Sagar* (PRM 915480).

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LITERATURE CITED

Aptroot, A., P. Diederich, E. Sérusiaux, and H.J.M. Sipman. 1997. Lichens and Lichenicolous Fungi from New Guinea. Bibliotheca Lichenologica, 64. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin–Stuttgart, pp. 1–220.

Arnold, F. 1878. Lichenoloogische Ausfluge in Tirol. XVIII. Windischmatrei. XIX. Taufers. Berichtigungen und Nachtrage. Verh. K. K. Zool. Bot. Ges. Wien, 28: 247–296.

Alstrup, V. and M.S. Cole. 1998. Lichenicolous fungi of British Columbia. The Bryologist 101(2): 221–229.

Berlese, A.N. 1899. Icones Fungorum omnium hucusque cognitorum ad usum Sylloges Saccardianae adcommodatae 2: [i]–[iv], 113–216 [plates 144–178].

Cesati, V. and G. De Notaris. 1863. Schema di classificazione degle sferiacei italici aschigeri piu' o meno appartenenti al genere Sphaeria nell'antico significato attribuitoglide Persono. Commentario della Società Crittogamologica Italiana 1(4): 177–420.

De Notaris, G. 1867. Nuove reclute per la pirenomicetologia italica. Comment. Soc. Crittog. Ital. 2(3): 477–492.

Diederich, P. 2003. New species and new records of American lichenicolous fungi [Neue Arten und neue Funde von amerkanischen lichenicolen Pilzen]. Herzogia 16: 41–90.

Eriksson, O. E. 1992. The non-lichenized pyrenomycetes of Sweden, Lund: SBT-forlaget, pp. 208.

Eriksson, O.E. and D.L. Hawksworth. 1993. Outline of the ascomycetes - 1993. Systema Ascomycetum 12: 51–257.

Etayo, J. and L.G. Sancho. 2008. Hongos liquenícolas del Sur de Sudamérica, especialmente de Isla Navarino (Chile). Bibliotheca Lichenologica, 98. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin–Stuttgart, pp. 1–302.

Ertz, D. 2004. *Neolamya*. In: Nash, T.H. III., Ryan, B.D., Diederich, P., Gries, C. and F. Bungartz (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 677–678.

Fries, E.M. 1849. Summa Vegetabilium Scandinaviae. Sectio posterior. . Sweden, Stockholm, Uppsala & Germany, Leipzig; Typographia Academica, pp. 259–572.

Gyelnik, V. ("Kofarago-Gyelnik"). 1940. De fungis lichenicolentibus Hungariae historicae I. Borbasia 1: 151–155.

Kalb, K., J. Hafellner, and B. Staiger. 1995. Lichenicole Pilze auf Arten der Flechtengattung *Haematomma*. Bibliotheca Lichenologica 59. J. Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin–Stuttgart, pp. 199–222.

Keissler, von K. 1930. Die Flechtenparasiten. *In*: Rabenhorst's Kryptogamen Flora, 2. ed., 8: 1–172.

Kocourková, J. 1999. Lichenicolous fungi from the Czech Republic. 1. *Weddellomyces xanthoparmeliae* Calatayud et Nav.-Ros. Czech Mycology 51: 179–184.

Kocourková, J. 2000. Lichenicolous fungi of the Czech Republic. (The first commented checklist). Acta Musei Nationalis Pragae, Série B, Historia Naturalis (1999): 59–169.

Kocourková, J. and K. Knudsen. 2008. Four new Lichenicolous Fungi from North America. – Evansia 25(2): 62–64.

Kümmerling, H. and V. Alstrup. 1992. Some peltigericolous fungi, mainly from Scandinavia. Graphis Scripta 3: 120–121.

Lumbsch, H.T. and S.M. Huhndorf (ed.). 2007. Outline of Ascomycota – 2007. Myconet 13: 1–58.

Migula, W. 1912–1913. Kryptogamen-Flora von Deutschland, Deutsch-Österreich und der Schweiz, vol. 3: Pilze, pars 2. *In*: Thomé's Flora Deutschland, Österreich und der Schweiz 10(3): 1–1004.

Montagne, J.F.C. 1845. De plantes cellularies exotiques nouvelles. Ann. Sci. Natur., ser. 3, vol. 4, p. 346–367.

Montagne, J.F.C. 1856. Sylloge generum specierumque cryptogamarum, quas in variis operibus descriptas iconibusque illustratas, nunc ad diagnosim reductas, nonnullasque novas interjectas, ordine systematico disposuit J.F. Cam. Montagne. Parisiis, J.-B. Baillire, 498 pp.

Olivier, H. 1907. Les principaux parasites de nos lichens francais. Bulletin de l' Academie internationale de géographie botanique, XVII. 123–128, 162–176, 232–240.

Roux, C. and D. Triebel. 1994. Révision des espčces de *Stigmidium* et de *Sphaerellothecium* (champignons lichénicoles non lichénisés, Ascomycetes) correspondant a *Pharcidia epicymatia* sensu Keissler ou a *Stigmidium schaereri* auct. Bulletin de la Société linnéenne de Provence 45: 451–542.

Saccardo, P.A. 1883. Sylloge Fungorum II 2: i, 1–815, ii–lxviii, 1–77. Italy, Padua; P.A. Saccardo.

Saccardo, P.A. 1891. Sylloge Fungorum 9: i, 1-1141. Italy, Padua; P.A. Saccardo.

Sérusiaux, E., P. Diederich, D. Ertz, and P. van den Boom. 2003. New or interesting lichens and lichenicolous fungi from Belgium, Luxembourg and northern France. IX. Lejeunia nouvelle série n° 173: 1–48.

Theissen, F. and H. Sydow. 1918. Vorentwürfe zu den Pseudosphaeriales. Annales Mycologici 16(1–2): 1–34.

Zhurbenko, M.P. 2004. Lichenicolous and some interesting lichenized fungi from the Northern Ural, Komi Republic of Russia. Herzogia 17: 77–86.

Zhurbenko, M.P. and J. Hafellner. 1999. Lichenicolous fungi from the Putorana plateau, Siberian Subarctic [Puturana platoo (Siberi subarktika) lihhenikoolne seened]. Folia Cryptogamica Estonica 34: 71–79.

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Four novel lichen taxa in the lichen biota of eastern North America

Richard C. Harris[1]

ABSTRACT. – Four new taxa are described affecting the lichen biota of eastern North America. Three are new species, *Bacidia kekesiana*, *Cladonia acuminans* (for the psoromic acid chemotype of *Cladonia acuminata*) and *Scoliciosporum pennsylvanicum*. The generic name *Leimonis* is provided to accommodate *Lecidea erratica*. *Bacidia kekesiana* and *Scoliciosporum pennsylvanicum* are illustrated. *Scoliciosporum pruinosum* is reported from eastern North America.

Introduction

As those who follow *Opuscula Philolichenum* are aware by now the lichen biota of eastern North America contains a plethora of undescribed lichen taxa. Three more species are dealt with here, driven in part by the acquisition of sufficient type material to distribute in the *Lichens of Eastern North America exsiccati*. The description of a generic name for *Lecidea erratica* Körber is prompted by 20 years of discomfort at treating it in *Micarea* Fr. where it has seemed to me from the beginning to be discordant (*Lecidea* Ach. seeming an even less desirable disposition).

Materials and Methods

Specimens were studied with a Zeiss Stemi 200-C dissection microscope and images of the thallus and apothecia were captured using an Olympus DP20 digital camera using Microsuite Special Edition. Microscopic characters were measured in water with an Olympus BX51 microscope and images were captured in the same manner as above. The chemistry of representative specimens of all species was studied with Thin Layer Chromatography (TLC) using solvent A following standardized methods.

The Taxa

1. *Bacidia kekesiana* R.C. Harris sp. nov.

Mycobank #513033.

Plate 2 (Page 154).

Bacidiae circumspectae valde similis sed excipulo epihymenioque cristalifero et conidiis brevioribus 4.5–5.5 x 1–1.2 µm differt.

Type: **U.S.A. VERMONT**. ESSEX CO.: Town of Ferdinand, Wenlock Wildlife Management Area, near Moose Bog, 44°45'44"N, 71°44'09W, flooded *Thuja* swamp and adjacent spruce-fir, on trunk of *Thuja* at edge of swamp, 18.v.2008, *R.C. Harris 54577* (NY, holotype; isotypes distributed as Lendemer, *Lichens of Eastern North America exs. no. 341*).

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DESCRIPTION. – **Thallus** immersed, white; photobiont "chlorococcoid", in clumps, globose, 9–15 µm in diam. **Apothecia** mostly mottled pale tan and greenish black with some becoming entirely greenish black, initially ± flat with evident margin but very soon swollen and margin often not evident, 0.2–0.5 mm in diam., to 0.4 mm high, sometimes several smaller ones aggregated (then to 0.7 mm in diam.); margin tan to greenish black. **Exciple** colorless filled with minute, ± evenly distributed crystals (appearing brownish, K soluble, N insoluble), composed of ± radiating anastomosing hyphae with thick gelatinized walls, with crystals at boundary of exciple, to ca. 120 µm thick. **Hypothecium** colorless, gelatinized (hyphae with thick walls), to ca. 130 µm high. **Epihymenium** patchily green (K–, N+ red–purple), without crystals. **Hymenium** green streaked above, colorless below, ca. 50 µm high. **Paraphyses** slender, embedded in gelatinous matrix, unbranched, 1.3–2.2 µm across with tips mostly not expanded, a few expanded to ca. 1.7 µm with pigmented sheath. **Asci** with 8 spores in a single bundle, not spirally arranged. **Ascospores** acicular, colorless, 0–3–septate, 20–25.1–30 x 1.6–1.9–2.4 µm. **Pycnidia** globose, immersed, ca.0.1 mm in diam. **Conidia** bacilliform, 4.5–5.5 x 1–1.2 µm.

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – This species is named to honor Jean Kekes, dedicated amateur bryologist, gourmet cook and generous gardener, who provided the opportunity to collect the specimen which precipitated its recognition as an undescribed species.

DISTRIBUTION AND ECOLOGY. – The three known collections of *Bacidia kekesiana* suggest that it is a northern species of moist woods. Two of the collections are from trunks of old sugar maples, perhaps hinting at a preference for old growth habitats.

DISCUSSION. – Although this distinctive species was first collected in Nova Scotia in 1999, its occurrence in New York (Harris 2006) and a large collection from Vermont suggested that the time had come to provide a name. *Bacidia kekesiana* is distinctive in that the exciple is densely filled with minute crystals. Ekman (1996) treats three species with minute excipular crystals, *Bacidia absistens* (Nyl.) Arnold, *B. aggregatula* Malme and *Bacidina crystallifera* S. Ekman. The first two differ in longer ascospores and filiform conidia. The third in pinkish apothecia and longer ascospores. In most characters, especially aspect and ascospores, *B. kekesiana* is very similar to *B. circumspecta* (Vain.) Malme differing in the exciple filled with crystals. The conidia match the type 1 noted for *B. circumspecta* by Ekman (1996) but are shorter (4.5–5.5 µm vs. 7–12 µm).

ADDITIONAL SPECIMENS EXAMINED. – **CANADA. NOVA SCOTIA**. QUEENS CO.: Kejimkukik National Park, along E shore of Kejimkujik Lake near inlet from Grafton Lake, 44°23'N, 65°12'W, mixed hardwood-conifer forest, on old *Acer saccharum*, 9.v.1999, *R.C. Harris 43111* (NY). **U.S.A. NEW YORK**. ALBANY CO.: Town of Knox, Limestone Rise Preserve along NY 146 ca. 5 mi W of Altamont, S of hwy, 42°42'03"N, 74°08'25"W, ca. 400 m, on old *Acer saccharum*, 24.ix.2005, *R.C. Harris 51826* (NY).

2. *Cladonia acuminans* R.C. Harris sp. nov.
MYCOBANK #513034.

Cladonia acuminata sed acidum psoromicum et atranorinum continens.

TYPE: **U.S.A. NEW YORK**. DUTCHESS CO.: Dover Plains, Roger Perry Memorial Preserve, S of Sand Hill Road, SE of jct with Lime Kiln Road, 41°43'52"N, 73°33'45"W, white calcareous sand and calcareous sandstone, on shaded, grassy slope, 4.xi.2008, *R.C. Harris 54800* (NY, holotype; isotypes distributed as Lendemer, *Lichens of Eastern North America exs. no. 342*).

DESCRIPTION. – As in *Cladonia acuminata* (Ach.) Norrlin. (full descriptions in Ahti (2000, p. 236) and Thomson (1984, p. 151, 152(fig.) as *C. norrlinii* Vainio) but containing psoromic acid and atranorin instead of norstictic acid and atranorin.

CHEMISTRY. – Atranorin, psoromic acid. Spot tests: K+ yellow, C–, KC–, P+ yellow, UV–.

Discussion. – One of the unintended consequences of increased knowledge of lichens (and other groups) is that the Linnaean nomenclatural system created as a shorthand designation for lengthy polynomials, cannot explicitly present additional information such as chemotype. This has led to the resurrection of polynomials such as "*Cladonia acuminata* (Ach.) Norrlin psoromic acid chemotype".

Cladonia acuminata (Ach.) Norrlin and var. *norrlinii* (Vain.) Lynge have been shown to contain atranorin and norstictic acid agg. (Huovinen et al, 1989). The psoromic acid chemotype has been incorrectly treated as *C. norrlinii* or *C. acuminata* var. *norrlinii*. Since no other shorthand name for the psoromic acid chemotype is available, one is provided here. (It is presumed to be a chemotype but no molecular data has been published to support this view.) Also, there is apparently some geographical separation as the psoromic acid chemotype does not seem to be reported from Europe, i.e., the norstictic acid chemotype is the only chemotype known from Norway (Krog et al. 1994), however Dahl and Krog (1973) incorrectly report both chemotypes (Tønsberg pers. comm.).

Interestingly *C. acuminata s. str.* was also present at the type locality of *C. acuminans*. Of three collections at this site two contained psoromic acid, one norstictic acid. There were many colonies so it would be interesting to make a study of the comparative frequency of the two.

3. *Leimonis* R.C. Harris gen. nov.

Mycobank #509017.

Genus Pilocarpacearum *Lecideae erraticae* characteribus: praecipue excipulum prosoplectenchymatum, ascosporae simplicia parvulae, pycnidiorum paries constatae ex cellulis globosis atrovirentibus, conidia oblonga non angustata, 4–6 x 1.5–2 µm, et lichenum substantia destituta.

Type: ***Leimonis erratica* (Körber) R. C. Harris & Lendemer comb. nov.**

Mycobank #509018.

Lecidea erratica Körber, Parerga lich. 223. 1861. *Micarea erratica* (Körber) Hertel, Rambold & Pietschmann, Bibliotheca lich. 34: 227. 1989. Type not designated (see Rambold, 1989).

Description. – **Thallus** on noncalcareous rock or rarely on old wood, pale to dark gray, epilithic, ± continuous, rimose–areolate to dispersed areolate, in harsh conditions reduced to a few tiny areoles and apothecia on a black, dendritic prothallus; photobiont "chlorococcoid"; no lichen substances detected. **Apothecia** often numerous, black, sessile, constricted at base, often flat with weakly raised, concolorous margin, sometimes becoming swollen with margin excluded, 0.2–0.3(–0.5) mm in diam. **Exciple** green outside, pale within, prosoplectenchymatous, of radiating, branched an interconnected hyphae . **Hypothecium** brown with brown pigment slightly radiating into exciple. **Epihymenium** green, K–, N+ red. **Hymenium** basically colorless, occasionally with granules of excipular or epihymenial pigments. **Paraphyses** basally branching, not or little expanded at tips. **Asci** of Pilocarpaceae type. **Ascospores** colorless, simple, narrowly ellipsoid, small, 6–9 x 2.5–3.5 µm. **Pycnidia** black, immersed, ca. 0.1 mm in diam., with green wall composed of ± globose cells. **Conidia** colorless, oblong, 4–6 x 1.5–2 µm. Additional descriptions by Coppins in Purvis et al (1992) and Rambold (1989).

Chemistry. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

Etymology. – *Leimonis* from Leimon = field, in reference to the common occurrence of *L. erratica* in open areas, especially old fields often in early stages of succession.

Distribution and Ecology. – In eastern North America *Leimonis erratica* is a species of exposed habitats occurring on non-calcareous rock, from tiny pebbles to substantial glacial erratics. It can often be found in old fields, on road banks, etc., apparently a pioneer species. NY holds material from virtually every state east of the Prairies from Nova Scotia and Ontario to Alabama and Georgia. It is also known from a single California collection at NY verified by Alan Fryday.

Discussion. – In connection with a revision of *Fellhanera* Vězda in eastern North America Harris and Lendemer have been forced to conduct detailed studies of several similar species. Among these is *Micarea*

erratica, a species included in *Lecidea s. l.* until Rambold (1989) transferred it to *Micarea*, another genus of the Pilocarpaceae that is distantly related to *Fellhanera*. I have long been uncomfortable about the inclusion of *Lecidea erratica* in *Micarea*. This was mainly a gut feeling based on the well developed exciple and well developed thallus.

Recent molecular studies of *Micarea s. l.* by Andersen and Ekman (2004) have shown that the genus *Micarea* is polyphyletic and further that after excluding unrelated species and species groups it is paraphyletic and consists of a number of well supported monophyletic groups. While the type species of *Micarea*, *M. prasina* Fr., was not included in the study the closely related *M. micrococca* (Körb.) Gams was shown to belong to a well supported group of taxa representing *Micarea s. str.* that is characterized by mostly pallid apothecia and 1-septate ascospores. In contrast, *Micarea erratica* was shown to belong to one of two well supported basal groups in the Pilocarpaceae.

I am not familiar with the other species which appear in the same clade and, thus, do not make any disposition of them. *Leimonis erratica* differs from the otherwise quite similar species of *Fellhanera* treated here in ascospore septation, prosoplectenchymatous exciple and oblong conidia. Further, Harris (1997) discussed *Leimonis* in connection with the somewhat similar *Lecidea cyrtidia* Tuck.

4. *Scoliciosporum pensylvanicum* R. C. Harris sp. nov.

MycoBank #513035.

Plate 1 (Page 153).

Affinis *S. pruinosi* sed apotheciis discoideis et ascosporis in ascis rectis (non spiralibus) differt.

Type: **U.S.A. PENNSYLVANIA**. WYOMING CO.: State Game Lands N0. 57, Sorber Mountain, orange trail, ca. 1.5 mi S of Stull, E of Noxen, Noxen Township, 41°24'25N, 76°05'30". Dry oak-birch forest with stands of poplar, on *Quercus* (in deep grooves), 20.vii.2008, *J.C. Lendemer 13611* (NY, holotype; isotypes distributed as Lendemer, *Lichens of Eastern North America exs. no. 339*).

Description. – **Thallus** corticolous, pale green, ± leprarioid, composed of granules (goniocysts); granules 20–45 µm in diam.; prothallus/hypothallus poorly developed, white, arachnoid; photobiont "chlorococcoid"; cells globose, thick-walled, 6–10 µm in diam. **Apothecia** whitish to pale brownish, often mottled, sessile, discoid, ± constricted at base, becoming slightly swollen, 0.1–0.3 mm in diam., many (remaining?) 0.1–0.15 mm, relatively few reaching 0.2–0.3 mm, ca. 0.1 mm high; margin indistinct, concolorous with disk. **Exciple** pale, filled with pale brownish, POL+ crystals, prosoplectenchymatous, weakly radiating, ca. 30 µm thick; hyphae irregular, branched and anastomosed, c. 1.5 µm in diam. **Hypothecium** colorless. **Epihymenium** pale, obscured by pale brownish lobaric acid crystals, K–, N–, POL+. **Hymenium** colorless, ca. 25–35 µm high. **Paraphyses** ± similar to excipular hyphae, coarser, but less branched and anastomosed; some terminal cells to 3µm, otherwise 1.7–2 µm in diam. **Ascus** ± *Bacidia* type, short cylindrical to obovate, ca. 25–30 x 8–10 µm, with 8 spores in a single bundle, not spirally arranged. **Ascospores** acicular, colorless, 3–septate, ca. 20–26 x 2 µm. **Pycnidia** ca. 0.1 mm in diam., pale, globose; conidia narrowly ellipsoid, 3–3.5 x 1.5–1.7 µm.

Chemistry. – Lobaric acid (major) and an unknown (minor). Spot tests: thallus, K–, C–, KC–, P–, UV+ bluish–white; apothecia, K–, C–, KC+ fleeting purple, P–, UV+ bluish–white.

Substrate and Ecology. – *Scoliciosporum pensylvanicum*, as now known, grows either in moist habitats or in moister microhabitats in drier forest (grooves in bark). Probably more common than present collections indicate and pale green, leprarioid crusts in bark grooves should be closely examined for the tiny apothecia.

Distribution. – Known from two counties in New Jersey and three in Pennsylvania.

Discussion. – *Scoliciosporum pensylvanicum* seems closely related to *S. pruinosum* (P. James) Vězda in having pale apothecia with small crystals of lobaric acid in exciple and epihymenium and in ecological preference. Because of this similarity, the species is included in *Scoliciosporum*. *Scoliciosporum pruinosum,* and therefore *S. pensylvanicum*, is not closely related to *Scoliciosporum s. str.* since Ekman (1996) assigns it to the *Bacidia lutescens* group, which is mainly ± tropical, except for *S. pruinosum*. The similarity of the paraphyses to the

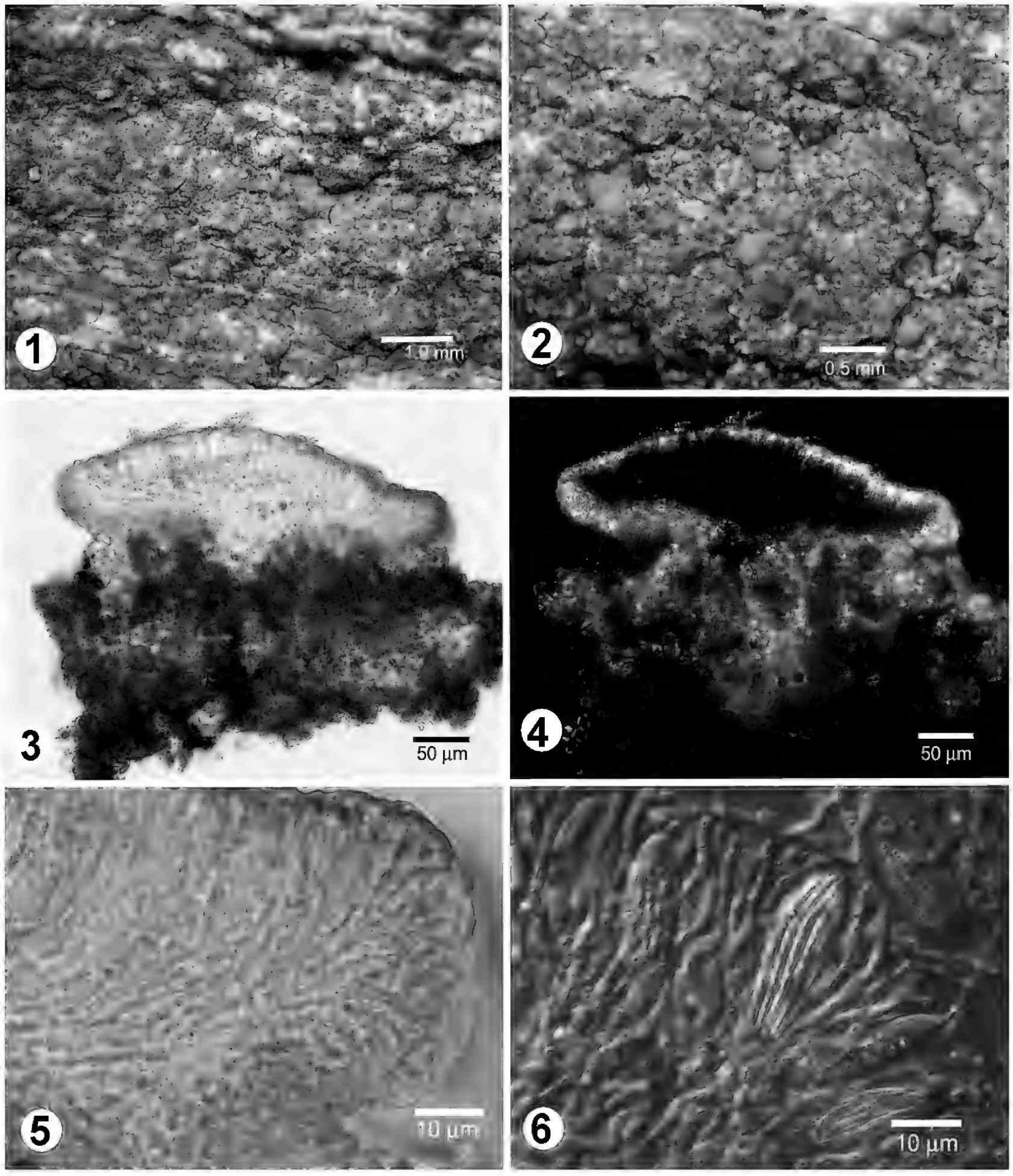

Plate 1. *Scoliciosporum pensylvanicum* (holotype, NY). Figures 1–2, habit. Figure 3, apothecium (cross-section). Figure 4, apothecium (cross-section, polarized light). Figure 5, exciple (detail). Figure 6, asci and spores (interference contrast).

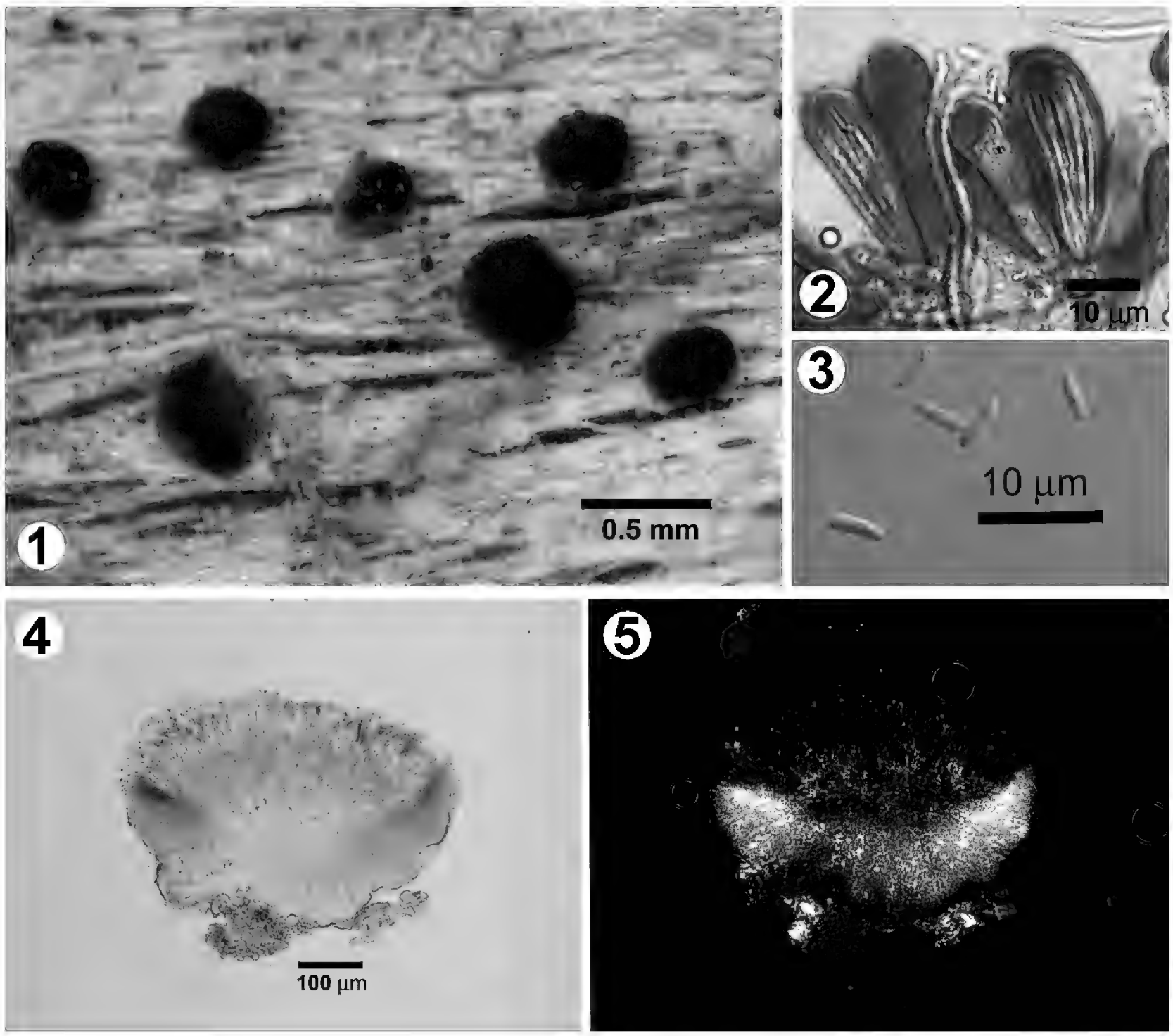

Plate 2. *Bacidia kekesiana* (holotype, NY), Figure 1, habit. Figure 2, asci and spores (KI). Figure 3, conidia (interference contrast). Figure 4, apothecium (cross-section). Figure 5, apothecium (cross-section, polarized light).

excipular hyphae in *S. pensylvanicum* is, however, suggestive of *Scoliciosporum*. *Scoliciosporum pruinosum* differs from *S. pennsylvanicum* in apothecial shape, in having the ascospores spirally arranged in the ascus, and probably in distribution (coastal vs. continental, see below). *Scoliciosporum pennsylvanicum* is also similar in aspect, ascus structure and chemistry to the recently described *Jarmania scoliciosporoides* Kantvilas from Tasmania (Kantvilas 2008). The *Jarmania* differs in having the thallus granules produced from a well developed byssoid prothallus and epruinose apothecia. A third lobaric acid containing species with acicular ascospores is *Bacidia lobarica* Printzen & Tønsberg (Printzen and Tønsberg 2007) which has larger, more septate ascospores (7(–19)–septate, 40–50 x 1.9–2.2 µm).

Scoliciosporum pruinosum was reported from the West Coast of North America by Tønsberg (1997). It has been collected recently on the East Coast, perhaps indicating a typical bicoastal maritime distribution [Maine, Washington Co.: Great Wass Island Preserve, on *Betula*, 10.vii.2008, *Buck 53900* (NY)].

Additional specimens examined. – **U.S.A. NEW JERSEY**. CAMDEN CO.: Wharton State Forest, 0.5 mi w of CR 536 (Chew Rd.), S. shore of Clark Branch, pitch pine-oak barrens, on *Quercus*, 6.ii.2009, *J.C. Lendemer 15471* (NY). OCEAN CO.: Manchester Wildlife Management Area, along N shore of Old Hurricane Brook, open pitch pine-oak forest, on *Quercus* in grooves of bark, 5.ii.2009, *J.C. Lendemer 15380-A* (NY), *J.C.*

Lendemer 15394 (NY). **PENNSYLVANIA**. COLUMBIA CO.: Roaring Creek Township, State Game Lands No. 58, along Twp. Rd. 397 (Fire Tower Road) ca. 1 mi WSW of Twp. Rd. 468 (Fisher Run Road), beyond one-lane bridge over Catawissa Creek at jct with PA 339, 40°57'12N, 76°23'12"W, oak dominated forest, on trunk of oak [in grooves], 23.iv.2008, *W.R. Buck 53593* (NY); HUNTINGDON CO.: Spruce Creek Township, Rothrock State Forest, Colerain Picnic Area, 1 mi NE of village of Spruce Creek, 1.7 mi SW of village of Franklinville, 40°37'41"N, 78°06'38"W, hemlock dominated forest, on base of *Acer* along river, 21.iv.2008, *W.R. Buck 53517* (NY).

Acknowledgements

I thank James Lendemer for his input regarding the recognition of *Leimonis*. Also Jack Elix and Tor Tønsberg for reviewing the manuscript.

Literature Cited

Ahti, T. 2000. *Cladoniaceae*. Flora Neotropica, 78, Organization for Flora Neotropica and New York Botanical Garden, Bronx. 362 pp.

Andersen, H.L, and S. Ekman. 2004. Phylogeny of the Micareaceae inferred from nrSSU DNA sequences. The Lichenologist, 36: 27–35.

Coppins, B. *in* Purvis, O.W., B.J. Coppins, D.L. Hawksworth, P.W. James, and D.M. Moore (eds.). 1992. *The Lichen Flora of Great Britain and Ireland*. Natural History Museum Publications & British Lichen Society, London. 710pp.

Dahl, E. and H. Krog. 1973. Macrolichens of Denmark, Finland, Norway and Sweden. Universitetsforlaget, Oslo. 185 pp.

Ekman, S. 1996. The corticolous and lignicolous species of *Bacidia* and *Bacidina* in North America. Opera Botanica, 127: 1–148.

Harris, R.C. 1997. Reinstatement of *Lecidea cyrtidia* Tuck. in the North American lichen checklist. Evansia, 14(3): 69–73.

Harris, R.C. 2006. Lichens of Limestone Rise Preserve, Albany County, New York. Evansia, 23: 53–55.

Huovinen, K., T. Ahti, and S. Stenroos. 1989. The composition and contents of aromatic lichen substances in *Cladonia* section *Helopodium* and subsection *Foliosae*. Annales Botanici Fennici, 26: 297–306.

Kantvilas, G. 2008. Observations on the genus *Scoliciosporum* in Australia with the description of a second species of *Jarmania*. The Lichenologist, 40: 213–219.

Krog, H., H. Østhagen, and T. Tønsberg. 1994. *Lavflora. Norske busk– og bladlav*. Utg. 2. Oslo. 1–368.

Printzen, C., and T. Tønsberg. 2007. *Bacidia lobarica* (Bacidiaceae, Lecanorales) sp. nov., a sorediate lichen from the southeastern U.S.A. The Bryologist, 110(3): 487–489.

Rambold, G. 1989. *A Monograph of the Saxicolous Lecideoid Lichens of Australia (Excl. Tasmania)*. Bibliotheca Lichenologica 34. J. Cramer, Berlin–Stuttgart. 345 pp.

Thomson. J.W. 1984. *American Arctic Lichens 1. The Macrolichens*. Columbia University Press, New York. 504 pp.

Tønsberg, T. 1997 [1998]. Additions to the lichen flora of North America VI. The Bryologist, 100(4): 522–524.

Opuscula Philolichenum, **6**: 157–174. 2009.

The *Fellhanera silicis* group in eastern North America

Richard C. Harris[1] & James C. Lendemer[2]

ABSTRACT. – A revision of *Fellhanera* in eastern North America resulted in the discovery of an undescribed complex of closely related taxa differing only in their methods of reproduction and/or the size of their dispersal units. The following species of *Fellhanera* are described as new to science: *F. eriniae*, *F. fallax*, *F. granulosa*, *F. hybrida*, *F. minnisinkorum*, *F. montesfumosi*, and *F. silicis*. Additional records for *F. floridana* are documented. The lichenicolous fungi found on members of the *F. silicis* group are discussed, including the new species *Phaeosporobolus fellhanerae*.

Introduction

The lichen genus *Fellhanera* Vězda has long been known from North America from *F. bouteillei* (Desmaz.) Vězda. Although most species of *Fellhanera* (including *F. bouteillei*) are foliicolous, several corticolous and saxicolous species have recently been recognized (Aptroot et al. 1998, Ekman 1996, Sérusiaux et al. 2001, Sparrius & Aptroot 2000, van den Boom 2004). The genus is poorly known in North America, with most of the species having been recently reported (Goward et al. 1996) or described (van den Boom 2004).

When the first author began studying the lichens of the Ozark Ecoregion he recognized a saxicolous *Fellhanera* that had been previously confused with superficially similar saxicolous species including *Bacidia granosa* (Tuck.) Zahlbr. (= *B. coprodes* (Körb.) Lettau) and *Micarea erratica* (Körb.) Hertel et al. A description of the taxon was included in an online treatment of undescribed Ozark lichens under the name *Fellhanera silicis*. Several years later, while collecting in the Delaware Water Gap National Recreation Area, we collected material of two additional *Fellhanera* species that were briefly discussed in print (Harris & Lendemer 2005). At that time we had intended to formally describe all three taxa in an upcoming publication, however further field work resulted in the accumulation a large amount of additional material some of which represented additional undescribed taxa. Finally, nearly a decade after the discovery of *F. silicis*, we have developed a preliminary treatment of *Fellhanera* in eastern North America that is presented here. In our region the genus is represented primarily by a complex of taxa that we hypothesize has only recently undergone speciation. With the exception of *F. floridana* (Tuck.) S. Ekman, which belongs to a group of orange fruited tropical species, all of the species so far discovered in eastern North America are nearly identical in characteristics of the apothecia and overall aspect of the thallus. Interestingly, the differences among these taxa center around methods of dispersal. A core group of species have identical ascospores and differ only in conidial size and the presence or absence of vegetative propagules. Two additional species differ further in having larger ascospores with more transverse septa (5–7 septa vs. 3 septa in most species).

In this treatment we first provide a key to the genus *Fellhanera* in North America with a supplementary key to normally sterile members of the *F. silicis* group (section I). Secondly, we provide formal descriptions and discussions of the members of the *F. silicis* group and include additional records of the little–known tropical species *F. floridana* (section II). A brief discussion of the origin and subsequent evolution of the *F. silicis* group follows the descriptive section of the treatment (section III). While revising specimens of *Fellhanera* we encountered two lichenicolous fungi on thalli of *F. granulosa*; these are also documented (section IV).

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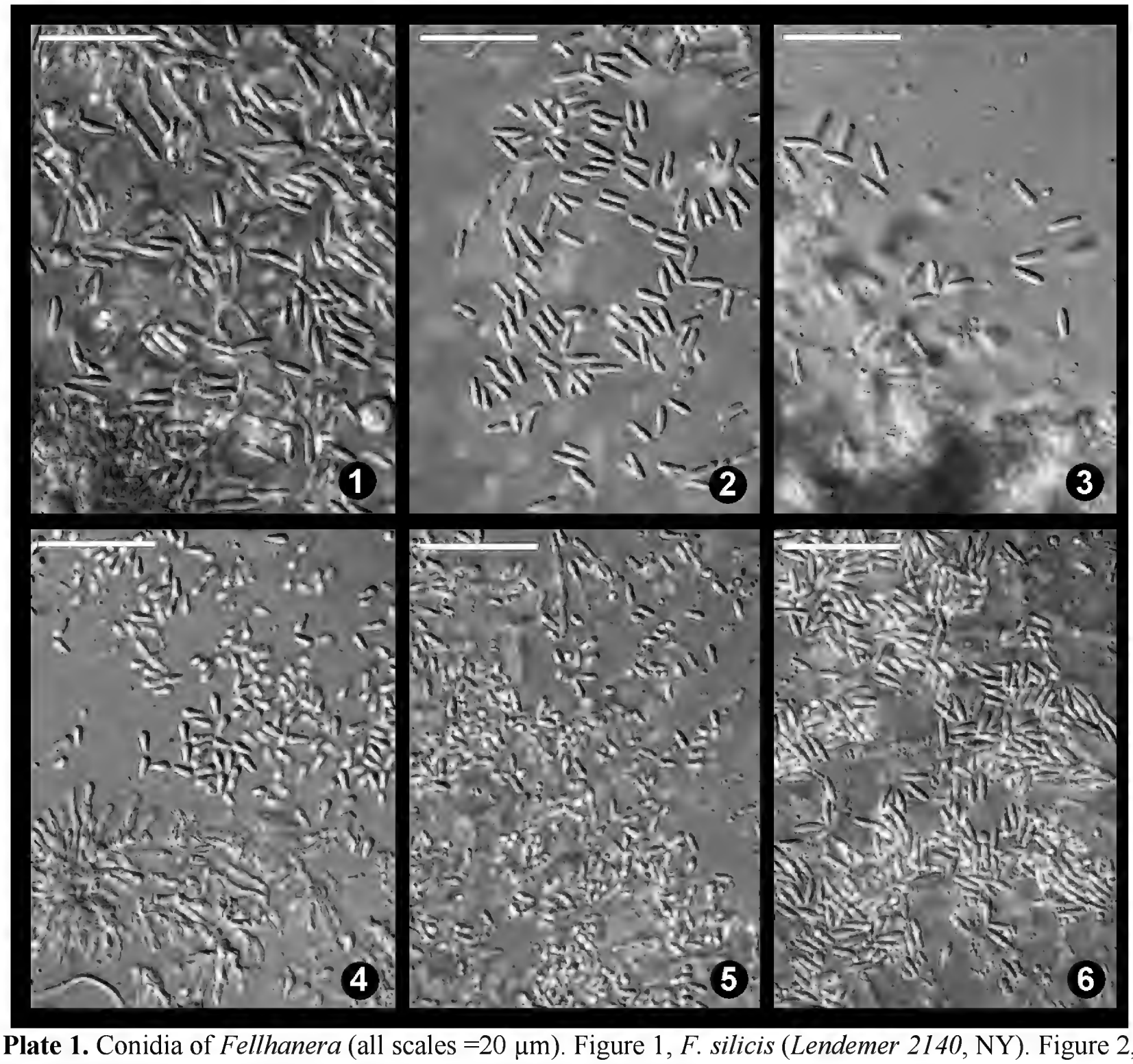

Plate 1. Conidia of *Fellhanera* (all scales =20 µm). Figure 1, *F. silicis* (*Lendemer 2140*, NY). Figure 2, *F. hybrida* (holotype). Figure 3, *F. montesfumosi* (holotype). Figure 4, *F. fallax* (holotype). Figure 5, *F. minnisinkorum* (holotype). Figure 6, *F. erinae* (holotype).

Materials and Methods

This study is based primarily on material collected by the authors throughout eastern North America over the last decade. All of this material is deposited in the herbarium of The New York Botanical Garden (NY). Specimens were studied with a Zeiss Stemi 200–C dissection microscope and images of the thallus and apothecia were captured using an Olympus DP20 digital camera using Microsuite Special Edition. Microscopic characters were measured in water with an Olympus BX51 microscope and images were captured in the same manner as above. Measurements of ascospores and conidia are based on the average (= xbar) of the number of measurements made (= n) plus or minus one standard deviation (= 1SD) from the average. Measurements are given in the following format: (xbar–1SD)–xbar–(xbar+1SD); sample size (n) is also provided. The chemistry of representative specimens of all species was studied with thin layer chromatography (TLC) using solvent A and following the standardized methods of Culberson and Kristinsson (1970). Common spot test reagents were also routinely used (e.g. following Brodo et al. 2001) and throughout the manuscript the following abbreviations are used for these: K or KOH for 10% solution of potassium hydroxide, N for concentrated HNO3, and C for Chlorox bleach.

	Thallus	Blastidia	Exciple	Epihymenial pigment	Hypothecium	Spores	Pycnidia	Conidia	Substrate	Range
silicis	thin to thick, ±continuous, rimose	none	cells ±distinct	green or ± absent	KOH+ purple	3-septate	abundant, gaping	5-7 µm	rock, rarely bark	widespread
crinae	thin, continuous film	isidioid-soredioid			KOH–	7-9-septate		5-6 µm	wood	Great Smoky Mtns.
fallax					KOH–			4-5 µm	rock, rarely bark	widespread
granulosa		granular to isidioid		brown or ± absent			sparse, immersed, not gaping	4-5 µm	rock, very rarely bark	Appalachian
hybrida		granular to isidioid					Usually sparse, immersed, not gaping	5-7 µm	rock, very rarely bark	Appalachian
minnisinkorum	thin, small areoles	granular to isidioid						4-5 µm	bark, wood, mosses, rarely rock	Northern + Ozarks
montesfumosi				± absent?		4-6-septate		5-7 µm	rock	Great Smoky Mtns.
sp. 1			cells very distinct	absent?			unknown	unknown	rock	Alabama

Table 1. Tabular comparison of critical characters of members of the *Fellhanera silicis* group. Diagnostic characters that deviate from *F. silicis* are shaded.

Taxonomic Treatment

Although the bulk of the genus *Fellhanera* is foliicolous, the taxa described here are all either corticolous, lignicolous, or saxicolous. It is this anomalous ecology that first drew our attention to the group. This ecology coupled with similarities in the anatomy of the thallus, sexual reproductive structures and chemistry (all taxa TLC–) led us to postulate a close relationship among the species. Despite the anomalous habit of these species, all share the basic characters of the genus *Fellhanera*: a cellular exciple, asci of Pilocarpaceae–type, colorless septate ascospores, and bowling pin or rod shaped conidia.

Fellhanera silicis is the most commonly collected and geographically widespread taxon, and as such we believe it occupies a core position in the group. This hypothesis is reflected in the detailed description of this taxon that is provided at the beginning of the taxonomic treatment. As all the other species found in the study area, excluding *F. floridana*, deviate from *F. silicis* only in several key characters, the descriptions of these taxa are abbreviated and intended primarily to illustrate differences from *F. silicis*.

I. – Key to Fellhanera in North America

While species of the *Fellhanera silicis* group are common and widespread in eastern North America, the identification of a given specimen can be difficult. While one can often collect apotheciate specimens at a given locality, it is most common to also find (and collect) populations and individual thalli that produce only pycnidia. Pycnidia are almost always present, conspicuous, and abundant (only in *F. granulosa* are they inconspicuous). They are also extremely variable in size and form; initially they are subglobose, producing conidia when they are at ~50 µm in diameter, and become gaping and irregularly cupuliform when mature (~200–300 µm in diameter). We have utilized differences in these structures to circumscribe the taxa recognized in the present treatment. This means that one is forced to locate pycnidia and measure conidia to identify a given specimen. A key for sterile specimens is provided following the main key below.

1. Thallus foliicolous; apothecia pale orange–yellow; ascospores 1–septate……..*F. bouteillei*
1. Thallus not foliicolous; apothecia dark brown–black; ascospores ≥ 3–septate……..…2

2. Ascus *Bacidia*–type; conidia filiform; on calcareous substrates ……*Bacidia coprodes*
2. Ascus Pilocarpaceae–type; conidia bowling pin or short bacillar; when saxicolous, on acidic rock……...3

3. Thallus with minute blastidia or goniocysts, rarely composed entirely of isidioid blastidia..4

4. Ascospores 5–9–septate; corticolous; Great Smoky Mountains…..…….. *F. eriniae*
4. Ascospores 3–septate; common……..……....5

5. Ascospores ovoid; saxicolous; Sonoran……...……..*F. nashii*
5. Ascospores fusiform–clavate; substrate various; eastern North America……..…6

6. Conidia 4–5 µm 7

7. Thallus thin, composed of small areoles; mostly corticolous/lignicolous; pigment in epihymenium green or absent; northern U.S. and Ozarks ……..... *F. minnisinkorum*
7. Thallus thicker, rimose; mostly saxicolous; pigment in epihymenium brown or absent; mostly Appalachian…..... *F. granulosa*

6. Conidia 5–7 µm ..... *F. hybrida*

3. Thallus without lichenized diaspores……..……..8

8. Ascospores 5–6–septate; Great Smoky Mountains……..... *F. montesfumosi*
8. Ascospores 3–septate ……..……..……..…… 9

9. Apothecia orange to orange–brown; corticolous; Florida ..... *F. floridana*
9. Apothecia dark, brown to blackish; mostly saxicolous; not from Florida..... 10

10. Exciple less distinct, variously pigmented; pycnidia present 11

11. Conidia 4–5 µm long ..... *F. fallax*
11. Conidia 5–7 µm long..... *F. silicis*

10. Exciple very distinct, mostly colorless, ± thin walled; pycnidia unknown; Alabama.....*F. sp. 1*

KEY TO COMMONLY STERILE (E.G., PRODUCING ONLY PYCNIDIA) MEMBERS OF THE F. SILICIS GROUP

1. Conidia 5–7 µm long 2

2. Without diaspores ..... *F. silicis*
2. Blastidiate ..... *F. hybrida*

1. Conidia 4–5 µm long 3

3. Without diaspores ..... *F. fallax*
3. Blastidiate 4

4. Thallus thin, composed of small areoles; mostly corticolous/lignicolous..... ..... *F. minnisinkorum*
4. Thallus thicker, rimose; mostly saxicolous ..... *F. granulosa*

II. – THE SPECIES

1. *Fellhanera silicis* R. C. Harris & Ladd sp. nov.

MYCOBANK #513138.

Aspectu valde similis *Micarea erratica* (Körber) Hertel vel *Bacidia coprodi* (Körber) Lettau, sat similis coloribus contexti apothecii et typo ascorum sed differt excipulo cellulis sat magnis subradiatis, ascosporis 3–septatis, 12–14 x 4–5 µm et microconidiis bacillaribus vel sublageniformibus, 5–6 x 1.8 µm.

TYPE: **U.S.A. MISSOURI**. GASCONADE CO.: Canaan Conservation Area, vicinity of parking area at end of Bock Road (CR 434)/Boettcher Road (CR 435), 2 mi E of Hwy A, ca. 3 mi N of Bland along Sulphur Branch, 38°20'10"N, 91°35'15"W, juniper woodland and oak woods with sandstone boulders, on chert, 25.iii.2006, *R.C. Harris 52015* (NY, holotype).

DESCRIPTION. – **Thallus** on siliceous rock, gray–green, olive–green, greenish brown or tan, occasionally browned or blackened, superficial, thin (reaching 80–100(–180) µm), initially continuous, becoming cracked, sometimes little more than a thin film, rarely becoming thick and ± warty in places, often with the surface minutely warty, without diaspores, without obvious prothallus, sometimes green pigmented below apothecium. **Apothecia** dark brown to black, matt, scattered to ± crowded, sessile, flat to moderately convex (ca. 150 µm thick), constricted to weakly constricted at base, 0.4–0.5 mm across when mature, with thin, concolorous margin or occasionally concolorous above, paler below, initially weakly raised, often becoming obscured with age. **Exciple** usually bicolored, outward colorless, inward greenish (KOH–, N+ red) at edge, brown to dark purplish brown (KOH+ purple, N+ orange–red) toward center; boundary with hypothecium usually indistinct; pigmented regions with darker granules; outer layer appearing cellular, composed of weakly radiating, thick walled hyphae with large, irregular lumina (2–4 µm across). **Hypothecium** brown to chocolate brown or dark reddish to purplish brown, KOH+ purple, N+ orange–red, with dark pigment granules. **Epihymenium** green (KOH–, N+ red); pigment present in variable amounts, sometimes sparse, rarely absent. **Hymenium** colorless, rarely ± greenish, appearing brownish streaked due to brownish pigment (KOH–) in some (moribund?) asci, rarely brown hypothecial pigments extending into lowermost hymenium. **Paraphyses** unbranched or moderately branched, and somewhat anastomosed, often contorted, with tips irregularly clavate or not expanded, often with wall of enlarged apical cells greenish. **Asci** clavate, Pilocarpaceae type,

octosporous. **Ascospores** colorless, ± fusiform, usually tapered at one end, 3–septate, slightly constricted at septa, (11.6)–14.4–(16.9) x (3.8)–4.2–(4.6) µm (n= 9), without an obvious halo. **Pycnidia black,** usually present ca. 0.1–0.2(–0.3) mm, initially subglobose with ostiole soon enlarged, then commonly gaping and pycnidium becoming ± cupulate and irregularly shaped with age exposing the whitish conidial mass, ± immersed to emergent, rarely sessile; wall greenish where exposed. **Conidia** bacillar to sublageniform, (4.9)–5.8–(6.8) x (1.5)–1.8–(2.1) µm (n= 20) [*Buck 31800* has larger pycnidia, opening more broadly, and larger bacillar conidia, 5–9 x 2–2.5 µm, forming short cirrhi]. **Chemistry**: TLC–.

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "sicilis" denotes the consistent occurrence of the species on siliceous rocks, an ecological difference separating it from the superficially similar but unrelated *Bacidia coprodes*.

DISTRIBUTION. – Based on the available material, the distribution of *Fellhanera silicis* is centered in the Ozark Ecoregion, with disjunct populations in the central Appalachian Mountains. The occurrence of a population in central Georgia suggests that the species is present elsewhere in eastern North America and as yet undetected. Interestingly, all specimens of *Fellhanera* from the southern Appalachians represent other taxa.

ECOLOGY. – As the specific epithet "silicis" suggests, this species shows a strong preference for acidic rocks. In the Ozarks, where it has been most commonly collected, it occurs on fine grained non–calcareous rock, especially weathered chert residum in open woodlands. It also occurs on siliceous inclusions in lime rich situations, rhyolite and fine grained sandstone. It grows in dry and mesic wooded habitats unlike *Micarea erratica* which typically occurs in open, sometimes xeric, habitats. Also, *Fellhanera silicis* regularly occurs on siliceous inclusions in carbonate bedrock in the Ozarks, suggesting that it may be more lime tolerant than *M. erratica*.

DISCUSSION. – *Fellhanera silicis* is clearly the most common and widespread species of the *F. silicis* group. The lack of lichenized diaspores (blastidia/isidia) easily separates it from most species in the study area except for *F. fallax* and *F. montisfumosi*. From *F. fallax*, a less common but nonetheless widespread species, it differs in having longer conidia and a KOH+ hypothecium. The rare and geographically isolated taxon *F. montisfumosi* differs from *F. silicis* in having longer ascospores with 4–6 transverse septa (vs. 3 in *F. silicis*). Occasionally thalli of *F. silicis* can be found that have bicolored apothecia. This two–toned appearance is due to an absence of the typical green pigment in the exciple and epihymenium of some apothecia.

SIMILAR SPECIES. – In the field and under the dissecting microscope *Fellhanera silicis* can pass for *Micarea erratica* which is widespread on non–calcareous rock in eastern North America. Further complicating hasty identifications, the green epihymenium and brown hypothecium also mimic *M. erratica*. However, 3–septate vs. 0–septate ascospores and broad celled, weakly radiate, thick walled excipular hyphae vs. narrow, much branched and anastomosed, thin walled excipular hyphae embedded in a well developed gel matrix, readily separate it from *L. erratica*.

Bacidia coprodes, normally easily separated from *F. silicis* by its almost exclusive preference for calcareous substrates, also occurs uncommonly on siliceous rock (perhaps with a calcareous wash). In such cases distinction from *F. silicis* requires examination of the asci, conidia, or excipular anatomy. The apothecial pigmentation is very similar but *Fellhanera* has an exciple of irregularly arranged enlarged cells while that of *B. coprodes* consists of radiating hyphae with only the end cell ± enlarged and the exterior of the *Fellhanera* exciple is colorless, whereas in *B. coprodes* the exciple is often ± uniformly dark. The ascospores of *F. silicis* are also broader, 4–5 µm versus 2.5–3.5 µm. The most definitive characters are the ascus type [broad, pale axial mass in *B. coprodes* (*Bacidia* type), tholus with a dark apical tube in *F. silicis* (Pilocarpaceae type)] and conidial type [(filiform, curved in *B. coprodes*, short, bacillar to bowling pin shaped in *F. silicis* (pycnidia usually present in both species)]. Llop & Ekman (2007) report finding short bacillar conidia in *B. coprodes* as well as filiform conidia. We suggest that the specimens with short conidia need to be re–examined in light of the recognition of *F. silicis* and its relatives.

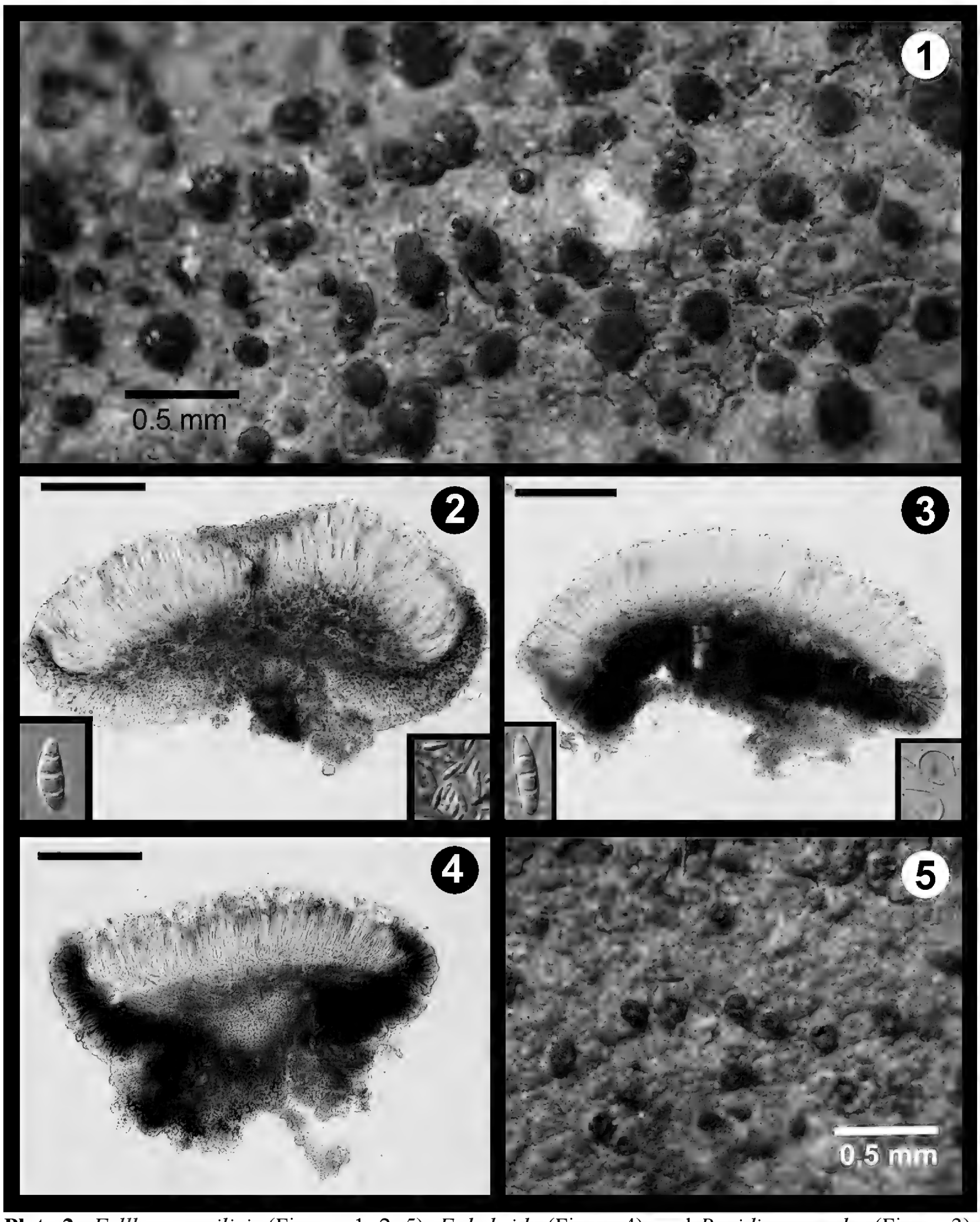

Plate 2. *Fellhanera silicis* (Figures 1, 2, 5), *F. hybrida* (Figure 4), and *Bacidia coprodes* (Figure 3). Figure 1. thallus and habit of *F. silicis* (holotype). Figure 2. Section of apothecium of *F. silicis* (*Buck 49694*, NY, scale = 100 µm); ascospore and conidia inset. Figure 3, Section of apothecium of *B. coprodes* (*Harris 50930*, NY, scale = 100 µm); ascospore and conidia inset. Figure 4. Section of apothecium of *F. hybrisa* (*Buck 48835*, NY, scale = 100 µm). Figure 5, pycnidia of *F. silicis* (*Buck 48769*, NY).

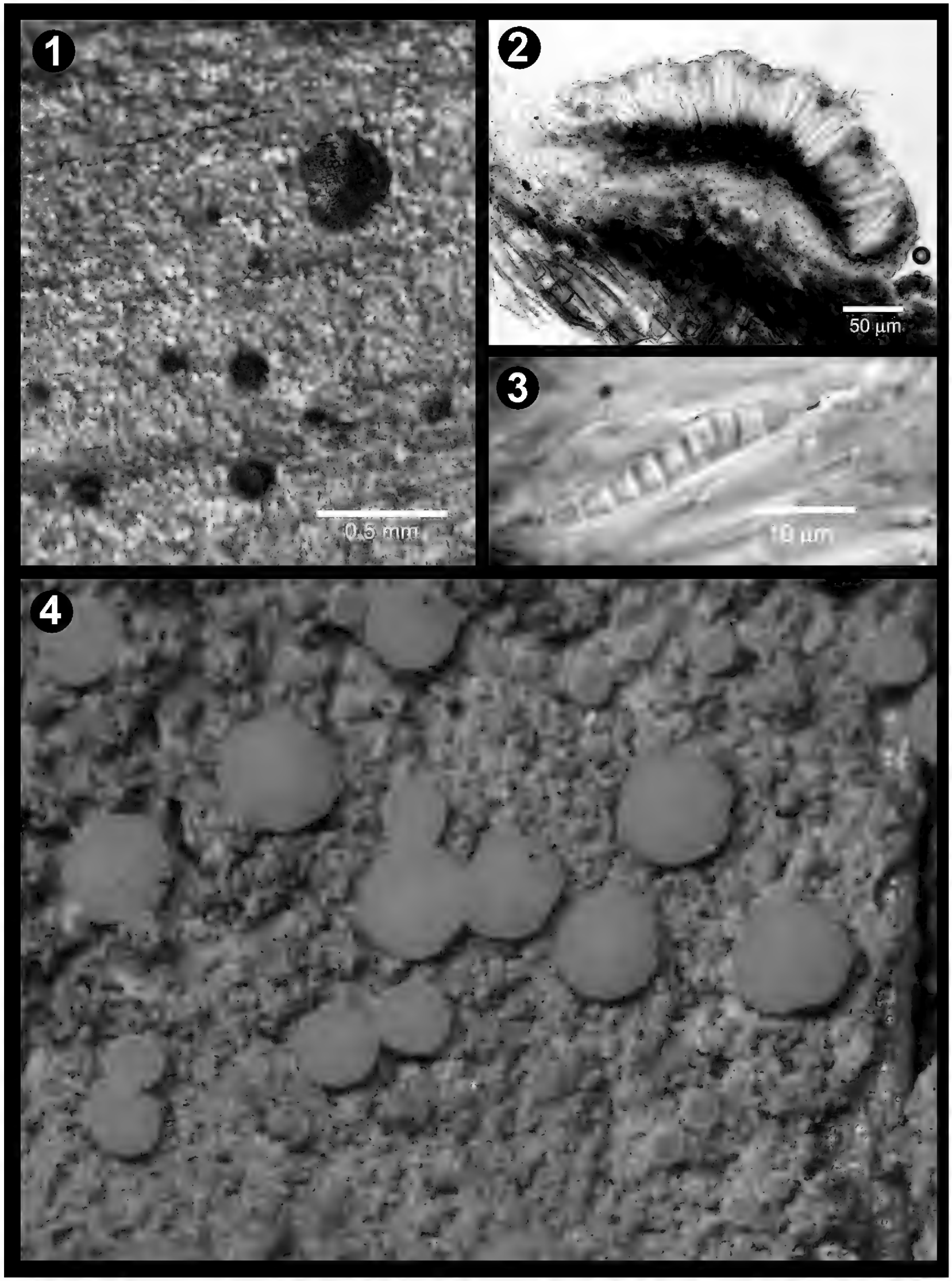

Plate 3. *Fellhanera erinae* (Figures 1-3, all from holotype) and *F. floridana* (Figure 4). Figure 1, thallus and habit of *F. erinae*. Figure 2, section of apothecium. Figure 3, ascospore. Figure 4, thallus and apothecia of *F. floridana* (*Wheeler s.n.*, NY, x5).

Selected Additional Specimens Examined. – **U.S.A. ARKANSAS**. BAXTER CO.: Ozark National Forest, Leatherwood Wilderness, 18.v.2005, *R.C. Harris 51188–B* (NY). BENTON CO.: Hobbs State Park Conservation

Selected Additional Specimens Examined. – **U.S.A. ARKANSAS**. BAXTER CO.: Ozark National Forest, Leatherwood Wilderness, 18.v.2005, *R.C. Harris 51188–B* (NY). BENTON CO.: Hobbs State Park Conservation Area, 17.iv.2004, *R.C. Harris 49403* (NY). GARLAND CO.: Hot Springs National Park, NW of West Mountain Overlook, 18.v.2001, *C.M. Wetmore 85686* (NY). NEWTON CO.: Buffalo National River, 17.iv.2005, *R.C. Harris 51092* (NY). POPE CO.: Ozark National Forest, Pedestal Rocks Scenic Area, 14.x.2005, *W.R. Buck 49405* (NY). SEARCY CO.: Buffalo National River, N of Woolum Campground, 17.iv.2005, *W.R. Buck 48795* (NY). SHARP CO.: Strawberry River Preserve, 25.x.2001, *W.R. Buck 40437* (NY). **GEORGIA**. BAKER CO.: Ichauway Plantation/Jones Ecological Center, *J.C. Lendemer et al. 9500* (NY, pycnidia only). **ILLINOIS**. RANDOLPH CO.: Piney Creek Ravine Nature Preserve, 7.xi.2004, *W.R. Buck 47674* (NY, pycnidia only). UNION CO.: Berrryville Shale Glade Nature Preserve, 6.xi.2004, *R. C. Harris 50498* (NY). **KANSAS**. CHEROKEE CO.: Spring River Wildlife Area, 13.iv.2004, *W.R. Buck 46389* (NY). **KENTUCKY**. CRITTENDEN CO.: north of Mattoon, 18.vi.1962, *C.F. Reed 58775* (NY). **MISSOURI**. BARRY CO.: Mark Twain National Forest, Piney Creek Wilderness, 27.iii.2006, *R.C. Harris 52173* (NY). BUTLER CO.: Mark Twain National Forest, Mud Creek Natural Area, 16.x.2003, *W.R. Buck 45425* (NY). CARTER CO.: Ozark National Scenic Riverways, Big Spring, 22.ix.1990, *R.C. Harris 25505* (NY). CHRISTIAN CO.: Mark Twain National Forest, Devreaux Ridge, 21.v.2003, *R.C. Harris 47661* (NY). DALLAS CO.: J. Haush farm ca, 3.5 mi N of Elkland, 11.ix.1987, *B. Summers 1894* (Ladd). FRANKLIN CO.: Meramec State Park, 23.iii.2006, *R.C. Harris 51917* (NY). GASCONADE CO.: Canaan Conservation Area, 25.iii.2006, *R.C. Harris 52047* (NY). GENEVIEVE CO.: Magnolia Hollow Conservation Area, 30.iii.2006, *J.C. Lendemer et al. 6748* (NY). LINCOLN CO.: Cuivre River State Park, 23.v.2003, *R.C. Harris 47794* (NY). MARIES CO.: Spring Creek Gap Conservation Area, 4.xi.2002, *W.R. Buck* 42795 (NY). OREGON CO.: Mark Twain National Forest, 17.iv.1997, *W.R. Buck 31936* (NY). OZARK CO.: Mark Twain National Forest, ridge E of Waterhole Hollow, 19.v.2003, *R.C. Harris 47416* (NY). POLK CO.: Pleasant Hill Wildlife Area, 17.vii.1987, *B. Summers 1782* (Ladd). TANEY CO.: Mark Twain National Forest, north of Forest Service Road 149, 20.v.2003, *R.C. Harris 47539* (NY). WASHINGTON CO.: Pea Ridge Conservation Area, 24.v.2003, *W.R. Buck 44687* (NY). **NEW YORK**: COLUMBIA CO: along NY 9G at Roeliff Jansen Kill, 31.viii.2001, *W.R. Buck 39876* (NY, pycnidia only, corticolous). **OHIO**. SCIOTO CO.: Shawnee State Forest, southern junction of roads 3 & 6, 21.v.2006, *J.C. Lendemer et al. 7192* (NY). **OKLAHOMA**. ADAIR CO.: Cookson Hills Wildlife Management Area, 1.xi.2000, *W.R. Buck 38616* (NY). CHEROKEE CO.: Cookson Wildlife Management Area, 14.iv.2004, *W.R. Buck 46472* (NY). **PENNSYLVANIA**. BEDFORD CO.: Buchanan State Forest, Pleasant Valley, 18.v.2006, *J.C. Lendemer et al. 7299* (NY, pycnidia only). BUCKS CO.: Nockamixon State Park, east of Kellers Church, 30.iii.2004, *J.C. Lendemer 2139 & A.F. Rhoads* (NY). CHESTER CO.: Ker–Feal, 15.iii.2007, *J.C. Lendemer 8716 & A.E. Schuyler* (NY), *J.C. Lendemer 8723 & A.E. Schuyler* (NY). HUNTINGDON CO: Trough Creek State park, 22.iv.2008, *J.C. Lendemer 11828* (NY). MONROE CO.: Delaware Water Gap National Recreation Area, Community Drive Wetland/Hogback Ridge, 24.iv.2004, *R.C. Harris 49538* (NY). WAYNE CO.: Dripping Cliffs TNC Preserve, 2.vii.2008, *J.C. Lendemer 12388* (NY, pycnidia only). **WEST VIRGINIA**. TUCKER CO.: Monongahela National Forest, Fernow Experimental Forest, 22.iv.2001, *R.C. Harris 44883* (NY).

2. *Fellhanera eriniae* R. C. Harris & Lendemer sp. nov.

Mycobank #513139.

Similis *Fellhaneae silicis* quoad apothecias et pycnidiis sed thallo lignicola, tenuissimo continuo nitente, blastidiis soredio–isidioidibus et ascosporis fusiformibus (5)–7–9–septatis, 25–32 x 2.5–5 µm.

Type: **U.S.A. NORTH CAROLINA**. HAYWOOD CO.: Great Smoky Mountains National Park, 3 mi SE of Waterville, along Baxter Creek Trail, S of Big Creek Campsite, Mount Sterling Ridge, lower slopes of Mount Sterling, Cove Creek Quad., rich cove forest (*Aesculus hippocastanum, Acer saccharum, Liriodendron tulipifera, Betula lenta, Halesia carolina*) on north–facing slope with narrow rocky ravine of Baxter creek, on fallen rotting branch, 28.x.2006, *J.C. Lendemer 8164 & E. Tripp* (NY, holotype).

Description. – **Thallus** lignicolous, a very thin continuous, slightly shiny, greenish film with pale scattered soredioid–isidioid blastidia. **Apothecia** essentially as in *F. silicis* except hypothecium KOH–. **Ascospores** hyaline, fusiform, transversely septate, (5)–7–9–septate, (24.8)–28.6–(32.4) x (2.6)–3.9–(5.2) µm (n= 8). **Pycnidia** as in *Fellhanera silicis*. **Conidia** hyaline, bacilliform, (5.1)–5.4–(6.1) x (1.0)–1.2–(1.4) µm (n= 20).

Chemistry. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "eriniae" honors the long time friend and colleague of the second author, Erin A. Tripp, who has contributed greatly to our knowledge of the lichens of the southern Appalachian Mountains. It is only fitting that such a distinctive species, which is potentially endemic to the region should carry her name.

DISTRIBUTION. – Presently known only from the Baxter Creek Watershed in the Great Smoky Mountains National Park. It is possible that this species is endemic to the humid forests of the southern Appalachian Mountains (Lendemer & Tripp 2008).

ECOLOGY. – *Fellhanera eriniae* is a lignicolous member of the *F. silicis* group, presently known only from the type collection, which was found on a rotting branch fallen from the canopy of a rich–cove mixed hardwood forest.

DISCUSSION. – Among the species of the *Fellhanera silicis* group, *F. eriniae* is noteworthy for its long, 4–8–septate ascospores which separate it from all species other than *F. montesfumosi*, another taxon endemic to the Baxter Creek Watershed which differs in its saxicolous habitat, KOH+ hypothecium, and lack of lichenized disaspores. In habit and thallus characters *F. eriniae* is most similar to *F. minnisinkorum* which differs in having typical 3–septate ascospores, smaller conidia, and a thallus composed of a minute thin areoles rather than a thin continuous film.

3. *Fellhanera fallax* R. C. Harris & Lendemer sp. nov.
MYCOBANK #513140.

Ut in *Fellanera silicis* sed hypothecio KOH– et conidiis brevioribus differt.

TYPE: **U.S.A. ILLINOIS**. JACKSON CO.: Shawnee National Forest, Fountain Bluff, along Happy Hollow Road 1.5 miles W of IL 3, sandstone outcrops in mixed hardwood forest, 7.xi.2004, *W.R. Buck 47658* (NY, holotype).

DESCRIPTION. – **Thallus** as in *F. silicis* although more often thin and continuous, never becoming very thick, on non–calcareous rock, very rarely on tree bases or roots. **Apothecia** as in *F. silicis* except hypothecium/exciple not reacting with KOH and epihymenium weakly pigmented, never dark green as is sometimes seen in *F. silicis*. **Ascospores** hyaline, fusiform, transversely septate, 3(–4)–septate, (12.3)–14.6–(16.8) x (3.7)–4.5–(5.2) µm (n= 20). **Pycnidia** as in *F. silicis*. **Conidia** hyaline sublageniform to bacilliform, (3–9)–4.5–(5.1) x (1.6)–2.0–(2.3) µm (n= 20).

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – This species is named "fallax", i.e., "deceptive" as it is inseparable in the field from *F. silicis*.

DISTRIBUTION. – Based on the available collections, *Fellhanera fallax* is distributed in the Ozark Ecoregion and adjacent Illinois and Kentucky, with disjunct occurrences in the central Appalachian Mountains. The lack of records from the southern Appalachian Mountains may merely be a result of collection bias (Lendemer & Tripp 2008).

ECOLOGY. – *Fellhanera fallax* is ecologically similar to the mostly sympatric species *F. silicis*, which also occurs on acidic siliceous rocks throughout eastern North America.

DISCUSSION. – The diagnostic features which separate *Fellhanera fallax* from the nearly identical *F. silicis* are the shorter conidia and the KOH– central exciple and hypothecium. Also similar is *F. montesfumosi*, a presumed southern Appalachian endemic which differs in having longer ascospores with more transverse septa and longer conidia.

Fellhanera fallax is much rarer than *F. silicis* and its occurrence in regions adjacent to the Ozarks is not unlike other taxa recently described by Harris and Ladd (2007). Unlike *F. silicis*, the majority (60%) of collections lack apothecia, and it is noteworthy that this includes all of the

specimens from the northern portions of its range (New York and Pennsylvania). It is possible that the lack of apothecia in these northern populations is an effect of being at the edge of range of the species, and that *F. fallax* is migrating northward following the warming climate after having adapted to slightly harsher northern conditions by focusing on asexual reproduction. Similarly, the dispersal and establishment of populations via conidia may confer some level of pollution tolerance because the species was found in the harsh urban conditions of a city park near downtown Philadelphia.

Additional Specimens Examined. – **U.S.A. ARKANSAS**. Benton Co.: Hobbs State Park–Conservation Area, 16.x. 2005, *J.C. Lendemer 5092* (NY, corticolous). **ILLINOIS**. Jackson Co.: same as type, *W.R. Buck 47647* (NY; pycnidia only). **KENTUCKY**. ROWAN CO.: Daniel Boone National Forest, 9.x.1995, *W.R. Buck 28474* (NY). **MISSOURI**. BUTLER CO.: Mark Twain National Forest, Mud Creek Natural Area, 16.x.2003, *W.R. Buck 45439* (NY). CHRISTIAN CO.: Mark Twain National Forest, Devereaux Ridge, 21.v.2003, *W.R. Buck 44558* (NY); IRON CO.: St. Francis Mountains, Clark National Forest, 13.x.1993, *R.C. Harris 31171* (NY). OREGON CO.: Mark Twain National Forest, Greer Spring Trail, 18.x.2003, *W.R. Buck 45594* (NY, pycnidia only); OZARK CO.: Mark Twain National forest, E of Waterhole Hollow, 19.v.2003, *W.R. Buck 44384* (NY, apothecia immature); PERRY CO.: Tower Rock Natural Area, 13.x.2003, *R.C. Harris 48224* (NY, pycnidia only). **NEW JERSEY**. HUNTERDON CO.: Mitchell Property, between Upper Creek and Pine Hill Roads, 4.xi.1992, *R.C. Harris 28995* (NY. corticolous). **NEW YORK**. PUTNAM CO.: Peach Lake Natural Area, 31.x11.2006, *W.R. Buck 51199*, 11.xi.2007, *W.R. Buck 52599, 52600* (NY, pycnidia only); **OKLAHOMA**. ADAIR CO.: Cookson Hills Wildlife Management Area, 1.xi.2000, *R.C. Harris 44463* (NY). **PENNSYLVANIA**. CARBON CO.: Hickory Run State Park, 5.vii.2008, *J.C. Lendemer 12559* (NY, pycnidia only); HUNTINGDON CO.: Trough Creek State Park, 22.1v.2008, *W.R. Buck 53558* (NY, pycnidia only); PHILADELPHIA CO.: Fairmount Park, Forbidden Drive along Wissahickon Creek, 3.iii.2007, *J.C. Lendemer 8602 & A. Moroz* (NY, pycnidia only).

4. *Fellhanera floridana* (Tuck.) S. Ekman

Discussion. – *Fellhanera floridana* is included here as it is the only other currently recognized corticolous *Fellhanera* in eastern North America. A short description and synonymy can be found in Ekman (1996).

Additional Specimens Examined. – **U.S.A. FLORIDA**. LAKE CO.: Eustis, *T.L. Mead* (NY, hb. Higginson 1038). PALM BEACH CO.: Lake Worth, 30.xii.1975, *W.R. Buck B759* (NY). POLK CO.: Bok Tower Gardens, 6.iii. 1989, *E.M. Wheeler s.n.* (NY), Nalcrest, 27.xi.1988, *E.M. Wheeler s.n.* (NY), 12.iii.1989, *E.M. Wheeler s.n.* (NY). **PUERTO RICO**. Rio Piedras, 12.i.1915, *B. Fink 534* (NY, 2x, isotypes of *Bilimbia finkii* Vainio).

5. *Fellhanera granulosa* R. C. Harris & Lendemer sp. nov.
Mycobank #513141.

Fellhanerae silicis similis sed thallo blastidiato, epihymenio brunneo, pycnidio sparso non hianti et conidiis minoribus 4–5 x 1.4–1.9 µm differt. *Fellhanerae minnisinkorum* subsimlis conidiis parvis et quoad blastidiae efferentem sed thallo crassiore, eiphymenio brunneo, pycnidio sparso non hianti, et pro magne parte in saxo crescente differt.

Type: **U.S.A. NORTH CAROLINA**. HAYWOOD CO.: Great Smoky Mountains National Park, 3 miles southeast of Waterville, along Big Creek, south of Big Creek Campsite, Mount Sterling ridge, lower slopes of Mount Sterling, Cove Creek gap, elev. 1780 ft, 35°44'51N, 83°06'58"W, riparian forest with many large boulders, on shale boulder along stream, 28.x.2006, *J.C. Lendemer 8211 & E. Tripp* (NY, holotype; DUKE, hb. Kalb, isotypes).

Description. – **Thallus** rimose, with granular to isidioid laminal blastidia or rarely entirely dissolved into isidioid blastidia. **Apothecia** similar to *F. silicis* but with disk often brown due to presence of brown epihymenial pigment or lack of epihymenial pigments. **Epihymenium** mostly to patchily pigmented dark brown, KOH–, N+ orangish brown, rarely some green pigment also present. **Ascospores** 3(–4)–septate, (13)–15.1–(17) x (3.5)–4.4–(5.5) µm (n = 20). **Pycnidia** sparse, immersed, apparently never gaping as in *F.* silicis, with exposed wall greenish. **Conidia** (3.9)–4.4–(4.9) x (1.4) – 1.6– (1.9) µm (n = 15).

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "granulosa" refers to the granulose appearance of the thallus due to the presence of laminal isidioid blastidia.

DISTRIBUTION. – *Fellhanera granulosa* has an Appalachian distribution, centered in the central and southern portions of the mountain range. There are disjunct occurrences in Illinois and central North Carolina.

ECOLOGY. – As with other members of the group, *Fellhanera granulosa* occurs on acidic rock in humid to very humid situations with a single collection from the base of a hardwood (*Carya*).

DISCUSSION. – As originally conceived (Harris & Ladd 2005) *Fellhanera granulosa* applied to a form where the thallus is entirely dissolved into coarse, elongated blastidia (Illinois, Saline Co., *Buck 35950*, NY; and Pennsylvania, Wyoming Co., *Lendemer 13663*, NY). Study of additional specimens led to the conclusion that there is a continuum from rimose thalli to entirely blastidiate thalli. Production of blastidia may be correlated with site humidity where in the most humid sites the entire thallus may consist of isidioid blastidia. The brownish apothecial discs of *F. granulosa* are a unique feature of the species that is due to the frequent occurrence of brown pigment in the epihymenium. Forms of *F. minnisinkorum* and *F. silicis* that lack the greenish epihymenial pigment that is typical of those species can appear similar to *F. granulosa,* however both species do not produce a brown pigment in the epihymenium and typically pigmented apothecia are almost always found on the same thallus. Also separating *F. granulosa* from the rest of the *F. silicis* group, except *F. hybrida*, are the sparse immersed pycnidia.

Fellhanera minnisinkorum is most likely to be confused with *F. granulosa* because of the presence of blastidia. That species however, has a primarily northern distribution in the Appalachian Mountains, greenish pigmented epihymenium, and shorter conidia. It also frequently occurs on lignum and the bases of trees rather than on rock. The presence of blastidia also could result in confusion with *F. eriniae* and *F. hybrida*. *Fellhanera eriniae* is a rare endemic of the southern Appalachian Mountains with longer more transversely septate ascospores and *F. hybrida* has longer conidia.

ADDITIONAL SPECIMENS EXAMINED. – **U.S.A. ALABAMA.** CHEROKEE CO.: Wolfden Flats, *W.R. Buck 36400* (NY). **GEORGIA**. RABUN CO:. Lake Burton Wildlife Management Area, vicinity of Popcorn Outlook, *J.C. Lendemer 7631, 7636* (NY). TOWNS CO.: Southern Nantahala Wilderness, Chattahoochee National Forest, Hightower Gap to Rich Knob, *J.C. Lendemer 10918, 10921* (NY). **ILLINOIS**. SALINE CO.: Shawnee National forest, Garden of the Gods Recreation Area, *W.R. Buck 35950* (NY). **NORTH CAROLINA**. HAYWOOD CO.: as type, *J.C. Lendemer 8170* (NY, pycnidia only). HENDERSON CO.: Pisgah National Forest, North Mills River Recreation Area, *W.R. Buck 50189, R.C. Harris 52579* (NY). WAKE CO.: William B. Umstead State Park, area south of Reedy Creek Lake, *J.C. Lendemer 8077* (NY), vicinity of lower Sycamore Lake, *J.C. Lendemer 8410* (NY). **PENNSYLVANIA**. LACKAWANNA CO.: Lackawanna State Park, S of Lackawanna Lake, *J.C. Lendemer 13241* (NY). LANCASTER CO.: Susquehannock State Park, vicinity of Phites Eddy, *J.C. Lendemer 11348* (NY). WYOMING CO.: State Game Lands No. 57, Henry Lott Road, *J.C. Lendemer 13624, 13663* (NY). **VIRGINIA**. GILES CO.: Mountain Lake Biological Station, along Pond Drain, *W.R. Buck 28322* (NY). **WEST VIRGINIA**. PENDLETON CO.: Monogahela National forest, along Smoke Hole Road, *W. R. Buck 38261* (NY).

6. *Fellhanera hybrida* R. C. Harris & Lendemer sp. nov.

MYCOBANK #513143.

Hybrida ut videtur inter *Fellhanerae silicis* et *F. granulosae*; thallus ut in *F. granulosam* et conidia ut in *F. silicem*. Ceterum ut in *F. silicem* sed pycnidiis inconspicuis non hiantibus.

TYPE: **U.S.A. NORTH CAROLINA**. WAKE CO.: William B. Umstead State Park, vicinity of lower Sycamore Lake, ~1 mile southwest of Ebenezer Church, on siliceous rock in dry creek, ridges and rocky ravine with small creeks and forest varying from disturbed (*Pinus, Betula, Acer*) to mature (*Fraxinus, Acer, Quercus*), 14.i.2007, *J.C. Lendemer et al. 8390* (NY, holotype; NY [ex hb. Lendemer], isotype).

DESCRIPTION. – **Thallus** thin to thick, cracked areolate with granular blastidia; white prothallus variously developed (very distinct in Ohio specimens). **Apothecia** as in *Fellhanera silicis*. **Ascospores** hyaline, fusiform, transversely septate, 3–septate, (13.5)–15.1–(17) x (3.4)–4.1–(5) µm. **Pycnidia** inconspicuous, immersed, not gaping. **Conidia** hyaline, bacilliform, (4.9)–6.1–(7.2) x (1.3)–1.7–(2) µm (n= 20).

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "hybrida" refers to the combination of features of two other distinct taxa in the *Fellhanera silicis* group, namely the blastidiate thallus of *F. granulosa* and the large conidia of *F. silicis*.

DISTRIBUTION. – The distribution of this species is centered in the piedmont of southeastern North America (Georgia to North Carolina) with scattered populations throughout the rest of the region and the Ozarks.

ECOLOGY. – *Fellhanera hybrida* is a relatively rare species of shaded siliceous rock with a single record known from the base of a tree.

DISCUSSION. – The saxicolous habit and large conidia of *Fellhanera hybrida* resemble those of *F. montesfumosi* and *F. silicis*; however, those species do not produce lichenized disaspores (blastidia) and *F. montesfumosi* has longer ascospores with more transverse septa. The production of blastidia in *F. hybrida* could lead to confusion with *F. granulosa* and *F. minnisinkorum*; however, both of those species have smaller conidia and their distributions are largely allopatric.

ADDITIONAL SPECIMENS EXAMINED. – **U.S.A. GEORGIA**. GWINNETT CO.: Little Mulberry Park, 22.iii.2007, *S.Q. Beeching 2935* (NY). **NORTH CAROLINA**. HENDERSON CO.: Pisgah National forest, North Mills River Recreation Area, 30.iv.2006, *J.R. Lendemer 7104* (NY). WAKE CO.: as type, 14.i.2007, *J.C. Lendemer et al. 8371* (NY), William B. Umstead State Park, Crabtree Creek area, 15.iv.2006, *G.B. Perlmutter 465* (NY). **OHIO**. SCIOTO CO.: Shawnee State Forest, 21.v.2006, *J.C. Lendemer et al. 7192* (NY), *7202* (NY, pycnidia only). **PENNSYLVANIA**. MONROE CO.: Delaware Water Gap Recreation Area, 25.iv.2004, *J.C. Lendemer 2693* (NY, on roots of tree). **WEST VIRGINIA**. POCAHONTAS CO.: Monongahela National Forest, Falls of Hills Creek, 9.vi.2007, *E.A. Tripp 208 & K. Deregibus* (NY).

7. *Fellhanera minnisinkorum* R. C. Harris & Lendemer sp. nov.

MYCOBANK #513144.

Similis *Fellhanerae silicis* quoad apothecias sed thallo blastidiato et conidiis minoribus 3.5–5 x 1.5–2 µm differt. Similis *Fellhanerae granulosae* quoad thallam blastidiatam et conidias sed epihymenio pigmento aeruginoso, thallo tenuiore, areolae parvae composito et substrato frequenter corticolo vel lignicolo differt.

TYPE: **U.S.A. PENNSYLVANIA**. MONROE CO.: Delaware Water Gap National Recreation Area, Community Drive Wetlands, lower north slopes of Hogback Ridge, ca. 2 miles south of Bushkill, wetlands, drained portions bordered by *Alnus* and swampy portions primarily with *Acer* and *Fraxinus*, bisected by Hogback Ridge forested with dense hemlocks (*Tsuga*) and large semi–calcareous rock exposures and boulders, on large rotting log (*Tsuga canadensis*), 24.iv.2004, *J.C. Lendemer 2410 & R.C. Harris et al.* (NY, holotype; NY [ex hb. Lendemer], hb. Kalb, isotypes).

DESCRIPTION. – **Thallus** pale gray–green when fresh, tan in herbarium, consisting of sparse minute areoles and often more numerous, more conspicuous granular to isidioid blastidia, sometimes appearing to occur directly on whitish cobwebby hypothallus/prothallus. **Apothecia** as *F. silicis* but the epihymenium tends to be ± colorless, rarely conspicuously green; hypothecium/exciple KOH+ purplish. A**scospores** hyaline, fusiform, transversely septate, 3–septate, (13.4)–16.3–(19.1) x (3.6)–

4.6–(5.6) µm (n= 6). **Pycnidia** Conspicuous, often gaping, as in *F. silicis* except always sessile due to thinness of thallus. **Conidia** hyaline, bacilliform, (3.6)–4.3–(4.9) x (1.5)–1.7–(1.9) µm (n= 20).

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "minnisinkorum" honors the Minnisink people, a group of Native Americans whose territory included the type locality and surrounding region.

DISTRIBUTION. – *Fellhanera minnisinkorum* is a northern species in eastern North America distributed primarily in the central/northern Appalachian Mountains with scattered populations in geologic outliers and in the Great Lakes Region.

ECOLOGY. – While most commonly found on the bark of conifers (*Juniperus*, *Thuja, Tsuga*) near the base of the trunk, it also frequently occurs on other high moisture substrates such as rotting logs and even bryophytes, as well as rarely on acidic rocks in humid areas.

DISCUSSION. – *Fellhanera minnisinkorum* is one of the two most common species of *Fellhanera* in eastern North America (the other being *F. silicis*). It was treated by Harris (1977) for Michigan as *Bacidia sp.* 2. Until the thallus variation in *F. granulosa* was understood, most of the material now treated as *F. granulosa* was included in *F. minnisinkorum*. *Fellhanera granulosa* differs in having a thicker, rimose thallus, inconspicuous, mostly immersed pycnidia and an epihymenium that is brown when pigmented. In abundantly fertile specimens, perhaps from drier sites, it seems that the production of blastidia is somewhat suppressed and, prompted by the short conidia, one may have to hunt to find blastidia. Thus confusion of saxicolous specimens with *F. fallax* is possible. Otherwise within the *F. silicis* group, *F. hybrida* is also similar to *F. minnisinkorum* in having a blastidiate thallus, but that species has longer conidia. *Fellhanera eriniae* could also be confused with *F. minnisinkorum* but the ascospores in that species are much longer with more transverse septa. The provisional name *Fellhanera "missouriensis"* (Harris & Ladd, 2005) was based on an atypical specimen of *F. minnisinkorum*.

SELECTED ADDITIONAL SPECIMENS EXAMINED. – **U.S.A. ILLINOIS**. COOK CO.: Glencoe, 11.xi.1905, *W.W. Calkins 173* (NY). JACKSON CO.: Shawnee National Forest, Pomona Natural Bridge, 15.x.1993, *W.R. Buck 24233* (NY, sandstone). **KENTUCKY**. PERRY CO.: Daniel Boone National Forest, Old Field Branch of Leatherwood Creek, 6.x.2001, *W.R. Buck 39902* (NY, sandstone). **MICHIGAN**. CLARE CO.: Townline Creek Swamp, 9.vi.1973, *R.C. Harris 8181* (NY). **MISSOURI**. IRON CO.: Pilot Knob National Wildlife Refuge, 30.iii.2006, *W.R. Buck 50046* (NY, haematitic rhyolite). ST. FRANCOIS CO.: St. Francois State Park, 19.iv.1997, *W.R. Buck 3211* (NY). **NEW JERSEY**. SUSSEX CO.: Sunrise Mountain (summit), 29.iii.2008, *J.C. Lendemer 11580* (NY, sandstone). **NEW YORK**. CLINTON CO.: Point Au Roche State Park, 17.x.1996, *W.R. Buck 30750* (NY), Valcour Island in Lake Champlain, 18.v.2007, *E. Kneiper s.n.* (NY, on *Rhodobryum ontariense*, pycnidia only). DUTCHESS CO.: Dover Plains, Roger Perry Memorial Preserve, 4.xi.2008, *W. R. Buck 54346* (NY, pycnidia only). JEFFERSON CO.: El Dorado Shore Preserve, 24.v.1997, *W.R. Buck 32237* (NY). NIAGARA CO.: Three Sisters, Niagara Falls, 2.xi.1988, *R.C. Harris 22893* (NY). **OHIO**. PIKE CO.: Strait Creek Prairie Preserve, 20.v.2006, *W.R. Buck 50284* (NY, on *Bryoandersonia illecebra*). **PENNSYLVANIA**. DAUPHIN CO.: State Game Lands #210, 10.iii.2007, *J.C. Lendemer 8648 & J. Stabley* (NY, hb. Lendemer). LANCASTER CO.: New Texas Serpentine Barrens, 8.iv. 2000, *W.R .Buck 36817* (NY). MONROE CO.: Delaware Water Gap National Recreation Area, Community Drive wetlands/Hogback Ridge, 24.iv.2004, *R. C. Harris* (NY). WYOMING CO.: State Game Lands No. 57, Henry Lott Road, 21.vii.2008, *J.C. Lendemer 13630* (NY).

8. *Fellhanera montesfumosi* R. C. Harris & Lendemer sp. nov.

MYCOBANK #513145.

Ut in *Fellhanerae silicis* quoad thallam, apothecias, pycnidias et conidias sed ascosporis (3)–4–6–(8)–septatis, 14–19 x 3.7–5.4 µm differt.

TYPE: **U.S.A. NORTH CAROLINA**. HAYWOOD CO.: Great Smoky Mountains National Park, 3 miles southeast of Waterville, along Baxter Creek Trail, south of Big Creek Campsite, Mount Sterling Ridge, lower slopes of Mount Sterling, Cove Creek Quad., rich

cove forest (*Aesculus hippocastanum, Acer saccharum, Liriodendron tulipifera, Betula lenta, Halesia caroliniana*) on north–facing slope with narrow rocky ravine of Baxter creek, on shaded rocks, 28.x.2006, *J.C. Lendemer 8169 & E. Tripp* (NY, holotype).

DESCRIPTION. – **Thallus** saxicolous, thin, continuous. **Apothecia** as in *Fellhanera silicis*. **Ascospores** hyaline, fusiform, tapering at one end, transversely septate, (3)–4–6–(7)–septate, constricted at middle septum and slightly constricted at outer septa, (14.3)–16.7–(19.0) x (3.7)–4.5–(5.4) µm (n= 10). **Pycnidia** as in *Fellhanera* silicis. **Conidia** hyaline, bacilliform, (6.4)–7.3–(8.2) x (15.)–1.8–(2.1) µm (n = 6).

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

ETYMOLOGY. – The epithet "montesfumosi" refers to the distribution of the species, which is known only from the type locality in the Great Smoky Mountains.

DISTRIBUTION. – Presently known only from the type locality in the Baxter Creek Watershed of the Great Smoky Mountains National Park.

ECOLOGY. – *Fellhanera montesfumosi* is a saxicolous member of the *F. silicis* group, known only from acidic rock outcrops at the type locality.

DISCUSSION. – Based on ascospore characters *Fellhanera montesfumosi* is most similar to *F. eriniae*, also known only from the (same) type locality. *Fellhanera eriniae* however, has a corticolous/lignicolous habit, blastidiate thallus, and shorter conidia. It is particularly noteworthy that the only two species in the *F. silicis* group with more than 3–septate ascospores have been found at the same locality. Similarly it is interesting that the characters separating the taxa (conidia size, presence/absence of blastidia, substrate preference) are the same as those separating the more widely distributed species *F. minnisinkorum* and *F. silicis*. It is likely that the lack of further collections of these taxa is a result of collection bias during previous surveys of the Great Smoky Mountains National Park.

9. *Fellhanera sp. 1*

DESCRIPTION. – **Thallus** a thin, continuous film. **Apothecia** similar to *F. silicis* but exciple mostly colorless of very distinct, thinner walled cells; epihymenium unpigmented; hymenium conspicuously brown streaked; hypothecium KOH–. **Ascospores** hyaline, 3–septate, (13.4)–14.4–(15.5) x (3.9)–4.2–(4.4) µm, n=5. **Pycnidia** unknown.

CHEMISTRY. – No substances detected. Spot tests: K–, C–, KC–, P–, UV–.

DISTRIBUTION. – This taxon is known only from the single locality in Alabama.

ECOLOGY. – The material was collected on sandstone in a very wet beech–magnolia–holly swamp forest.

DISCUSSION. – It is difficult to place these specimens as they lack pycnidia — one of the most critical characters in this group. The KOH– hypothecium suggests *F. fallax* but differs in excipular anatomy and the heavily brown streaked hymenium. Additional material is needed to resolve placement of this material.

SPECIMENS EXAMINED. – **US.A. ALABAMA**. MONROE CO.: Haines Island Park, 31.vii.2003, *W.R. Buck 44850* (NY), *W.R. Buck 44860* (NY).

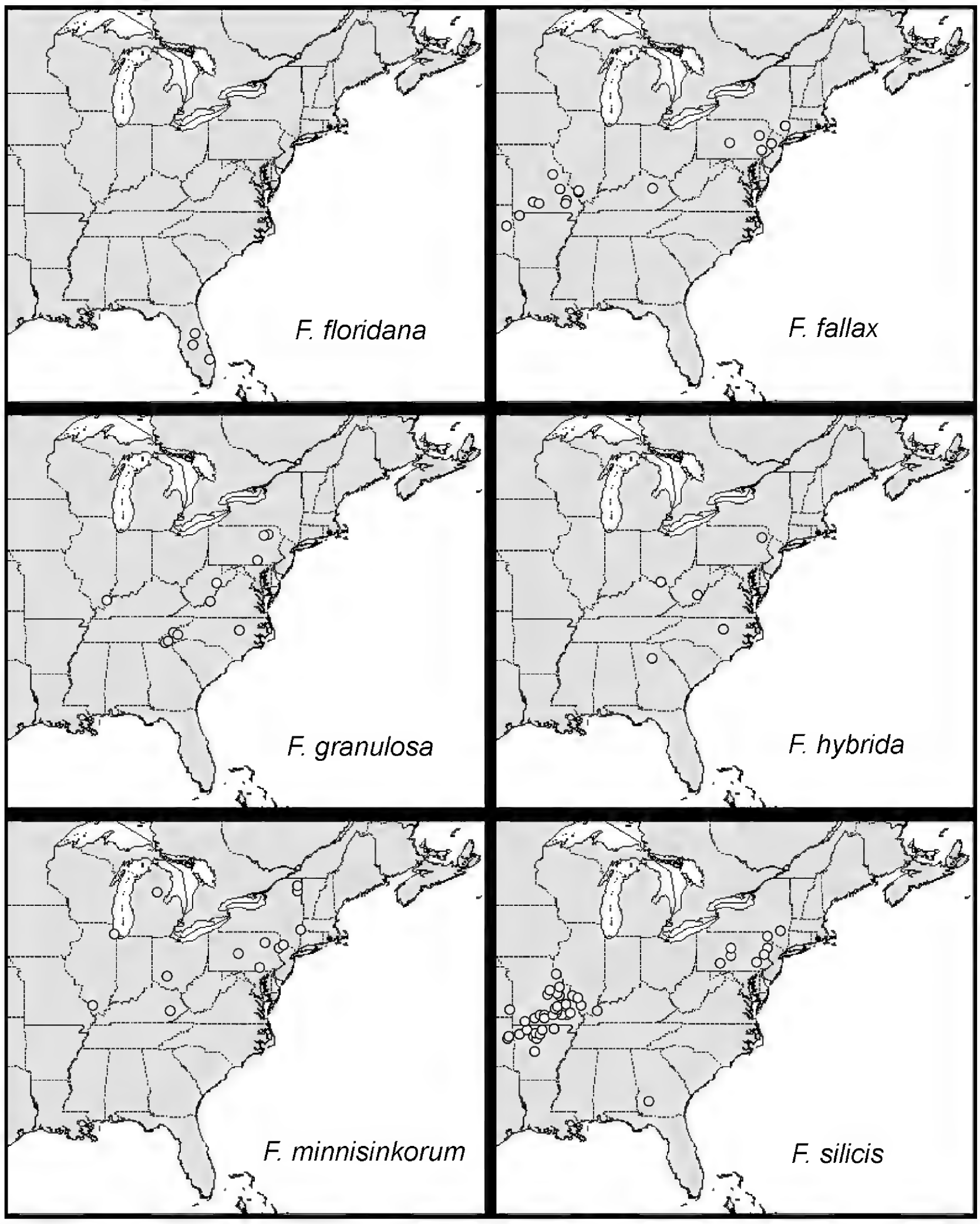

Plate 4. Geographic distributions of *Fellherna floridana, F. fallax, F. granulosa, F. hybrida, F. minnisinkorum,* and *F. silicis* in North America.

III. – Discussion of the F. silicis group

The *Fellhanera silicis* group as circumscribed here represents a diverse assemblage of closely related saxicolous and lignicolous species that differ in their ecologies, geographic distributions, and reproductive strategies. The ecology of the *F. silicis* group is anomalous in the broader context of the largely foliicolous genus *Fellhanera*. The characters of the thallus and anatomy of the apothecia are virtually identical in the species that comprise group. At the center of the group is a common and widely distributed species, *F. silicis*, which regularly produces sexual fruiting bodies. Five of the other seven members of the group, which differ from *F. silicis* in aspects of asexual reproduction (e.g. conidial size and/or the production of lichenized diaspores), frequently do not produce apothecia, and thus would seem to reproduce primarily by asexual means. Two other taxa are presently known only from Great Smoky Mountain National Park in the southern Appalachian Mountains and differ from the other members of group in the size and shape of the sexual dispersal units (ascospores). These two species, *F. eriniae* and *F. montesfumosi* further differ from each other in aspects the asexual dispersal units in the same manner that the rest of the *F. silicis* group differs from each other and from *F. silicis*. Clearly this group is a perfect example where detailed studies with molecular methods could shed significant light on evolution and asexual speciation in lichenized fungi.

IV. – Lichenicolous Fungi of the F. silicis group

Two lichenicolous fungi have been encountered on members of the *Fellhanera silicis* group, in both cases on thalli of *F. granulosa*.

1. *Neocolera inundata* (Vain.) Diederich ?

Discussion. – A single collection of *Fellhanera granulosa* from North Carolina was infected with a species of *Neocolera* Petr. The material may represent *N. inundata*, a species lichenicolous on members of the genus *Bacidina* Vězda; however due to the limited material it was not possible to make a conclusive identification.

Specimen Examined. – **U.S.A. NORTH CAROLINA**. HENDERSON CO.: Pisgah National Forest, North Mills River Recreation Area, 30.iv.2006, *R.C. Harris 52580* (NY).

2. *Phaeosporobolus fellhanerae* R. C. Harris & Lendemer sp. nov.

Mycobank #513146.

Phaeosporobolus supra *Fellhaneram granulosam* crescens, stromatibus irregulariter orbicularibus, sessilibus, ca. 0.1 mm diametris in centro fuscantibus et conidiis irregulariter ellipsoideis, 11–12 x 7.5–8.5 µm, e ca. 20 cellulis globosis compositis.

Type: **U.S.A. NORTH CAROLINA**. HAYWOOD CO.: Great Smoky Mountains National Park, 3 miles southeast of Waterville, along Baxter Creek Trail, south of Big Creek Campsite, Mount Sterling Ridge, lower slopes of Mount Sterling, Cove Creek Quad., rich cove forest (*Aesculus hippocastanum, Acer saccharum, Liriodendron tulipifera, Betula lenta, Halesia Carolina*) on north–facing slope with narrow rocky ravine of Baxter creek, on *Fellhanera granulosa* on rock, 28.x.2006, *J.C. Lendemer 8087 & E. Tripp* (NY, holotype).

Description. – **Stromata** on the thallus of *Fellhanera granulosa*, irregularly orbicular, sessile, to ca. 0.1 mm across by ca. 0.1 mm high (including short stipe), dark brown, (microscopically brown with dark brown center); outer cells with irregularly ornamented walls. **Conidia** multicellular, composed of ca. 20 globose cells, ca. 11–12 x 7.5–8.5 µm, smooth.

Etymology. – The epithet "fellhanerae" refers to the genus of the type host of the species, *Fellhanera* Vězda.

Discussion. – *Phaeosporobolous fellhanerae* is close to *P. alpinus*, differing in conidial shape (subglobose in *P. alpinus*) and in growing on *Fellhanera*, a genus quite distant from *Ochrolechia* and *Pertusaria*, the host genera of *P. alpinus*. The species is known only from the type collection.

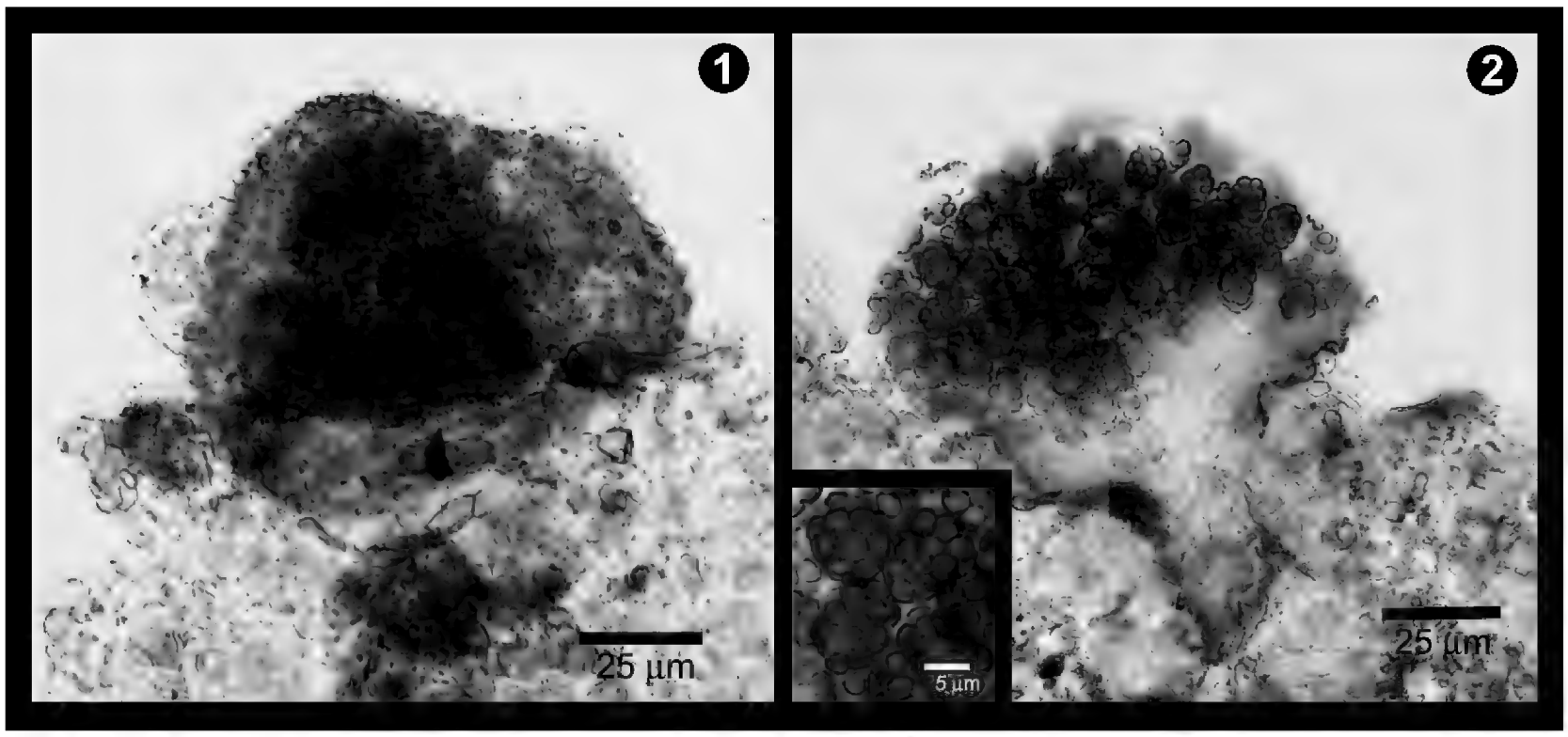

Plate 5. *Phaeosporobolus fellhanerae* (all from holotype). Figure 1, stroma. Figure 2, stroma (cross-section with conidia inset).

Acknowledgements

We thank Robert Lücking for discussion of the relationship between the *F. silicis* group and the rest of *Fellhanera* Vězda. We also thank Brian Coppins for helpful discussion and both Doug Ladd and Robert Lücking for reviewing the manuscript. Erin Tripp aided the second author significantly in logistics and collecting within her long-term study plot in Great Smoky Mountains National Park, an area that seems to host many rare and endemic lichen species. Funding for field work undertaken by the second author in Pennsylvania was provided in part by grants from the Wildlife Conservation and Resource Fund (WCRF) of the Department of Conservation and Natural Resources of Pennsylvania (DCNR) and the Western Pennsylvania Conservancy (WPC). Gary Perlmutter is thanked for sending specimens for identification that altered us to the existence of *F. hybrida.* Sean Q. Beeching and Malcolm Hodges are thanked for their hospitality to the second author and for their companionship on several field trips in the southeastern United States during which copious material of *Fellhanera* was collected.

Literature Cited

Aptroot, A., M. Brand, and L. Spier. 1998. *Fellhanera viridisorediata*, a new sorediate species from sheltered trees and shrubs in western Europe. The Lichenologist, 30(1): 21–26.

Brodo, I.M., S. Duran Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven & London. 795 pp.

Culberson, C.F., and H. Kristinsson. 1970. A standardized method for the indentification of lichen products. Journal of Chromatography, 46: 85–93.

Ekman, S. 1996. The corticolous and lignicolous species of *Bacidia* and *Bacidina* in North America. Opera Botanica, 127: 1–148.

Goward, T., O. Breuss, B. Ryan, B. McCune, H. Sipman, and C. Scheidegger. 1996. Notes on the lichens and allied fungi of British Columbia. III. The Bryologist, 99(4): 439–449.

Harris, R.C. 1977: *Lichens of the Straits Counties, Michigan*. – Publ. by the author. 150 pp.

Harris, R.C. and D. Ladd. 2005. Preliminary draft: Ozark Lichens, Publ. by the authors, 247 pp.

Harris, R.C. and D. Ladd. 2007. New taxa of lichens and lichenicolous fungi from the Ozark Ecoregion. Opuscula Philolichenum, 4: 57-68.

Harris, R.C. and J.C. Lendemer. 2005. Contributions to the Lichen Flora of Pennsylvania: A Checklist of the Lichens Collected During the 1st Howard Crum Bryological Workshop, Delaware Water Gap National Recreation Area. Opuscula Philolichenum, 2: 1–10.

Lendemer, J.C. and E. Tripp. 2008. Contributions to the Lichen Flora of North Carolina: A Preliminary Checklist of the Lichens of Gorges State Park. The Bryologist, 111(1): 4–67.

Llop, E. and S. Ekman. 2007. *Bacidia coprodes*—resurrecting a misinterpreted species. The Lichenologist, 39(3): 251–257.

Sérusiaux, E., B.J. Coppins, P. Diederich, and C. Scheidegger. 2001. *Fellhanera gyrophorica*, a new European species with conspicuous pycnidia. The Lichenologist, 33(4): 285–289.

Sparrius, L.A., and A. Aptroot. 2000. *Fellhanera ochracea*, a new corticolous lichen species from sheltered habitats in western Europe. The Lichenologist, 32(6): 515–520.

van den Boom, P.P.G. 2004. *Fellhanera*. *In*: Nash III, T.H., B.D. Ryan, P. Diederich, C. Gries, and F. Bungartz (eds.): Lichen Flora of the Greater Sonoran Desert Region, Vol. 2. Lichens Unlimited, Arizona State University, Tempe, Arizona, pp. 107–108.

Opuscula Philolichenum, **6**: 175–183. 2009.

Lichens of Eastern North America Exsiccati, Fascicle VII, Nos. 301-350

James C. Lendemer[1]

ABSTRACT. – Data for the seventh fascicle, comprising the nos. 301 to 350, of *Lichens of Eastern North America Exsiccati* is presented. The exsiccat is distributed to ASU, B, BG, CANB, CHR, DOV, FH, GZU, H, HMAS, KANU, LD, M, MIN, NY, PRM, S, TSB, TNS, TU, UPS and hb. Kalb.

Introduction

In conjunction with the author's work on the lichen biota of eastern North America he began the distribution of this exisccat (*Lichens of Eastern North America Exsiccati*) from the Academy of Natural Sciences of Philadelphia (PH). This, the seventh fascicle in the series is distributed from the New York Botanical Garden (NY) where the author is now employed. This fascicle comprises the nos. 301-350, and is distributed in 20 sets on exchange to the following herbaria: ASU, B, BG, CANB, CHR, DOV, FH, GZU, H, HMAS, KANU, LD, M, MIN, NY, PRM, S, TSB, TNS, TU, UPS and hb. Kalb. Incomplete sets are distributed to UCR, and PRM.

Fascicle VI

301. *Cladonia maxima* (Asahina) Ahti
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Cape Norman, west of Wild Bight. – Lat. 51° 37' 09" N, Long. 55° 53' 57" W – Ordovician limestone/dolostone pavement barrens and cliffs exposed to the sea. – On soil in pockets of coastal cliffs.

James C. Lendemer **#11122** & Andy Moroz 15.August.2007

302. *Graphis sophisticascens* Nyl.

UNITED STATES OF AMERICA. KANSAS. CHAUTAUQUA COUNTY.: 2.25 mi S of Niotaze, along Birch Creek, E from Rd 29 crossing 0.1 mi N inters of Rd 29 & Cowboy. – T35S R13E Sec. 05 SW ¼ of NW ¼ - ca. Lat. 37.0333° N, Long. 96.0188° W – elev. 790-800 ft. – Disturbed, weedy, floodplain river birch-sycamore forest with shrubby understory. Soil sandy. – Locally abundant on bark of large *Betula*.

Caleb A. Morse **#15699** 18.September.2007

303. *Xanthoria sorediata* (Vainio) Poelt
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Cape Norman, west of Wild Bight. – Lat. 51° 37' 09" N, Long. 55° 53' 57" W – Ordovician limestone/dolostone pavement barrens and cliffs exposed to the sea. – On soil in pockets of coastal cliffs.

James C. Lendemer **#11122** & Andy Moroz 15.August.2007

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304. *Chaenothecopsis rappii* (Nadv.) R.C. Harris
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. FLORIDA. HENDRY COUNTY.: Okaloacoochee Slough State Forest, on North Loop-West, 0.15 mi N of CR 832, 3.7 mi W of SR 29. – Lat. 29° 36' 05"N, Long. 81° 22' 35"W – Palmetto-*Myrica* scrub around slough. – On trunks of *Sabal palmetto*.

James C. Lendemer **#15783** 6 March 2009

305. *Protoblastenia incrustans* (DC.) J. Steiner
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Burnt Cape Ecological Preserve, north end of cape, town of Raleigh, Ha-Ha Bay. – Lat. 51° 35' 20" N, Long. 55° 44' 04" W – Coastal cliffs of extensive (Ordovician) limestone/dolostone barren and adjacent peat deposits (exposed from forest fire ~20 years before) surrounding glacial erratics. – On limestone.

James C. Lendemer **#11179** & Andy Moroz 14.August.2007

306. *Placynthium nigrum* (Huds.) Gray
Det. J.C. Lendemer, 2007

CANADA. NEWFOUNDLAND.: Island of Newfoundland, Northern Peninsula, Burnt Cape Ecological Preserve, south end to middle of cape, town of Raleigh, Ha-Ha Bay. – Lat. 51° 35' 20" N, Long. 55° 44' 04" W – Extensive (Ordovician) limestone/dolostone barren with tuckamore forest and humus pockets around stunted trees with occasional glacial erratics. – On limestone.

James C. Lendemer **#11268** & Andy Moroz 13.August.2007

307. *Cladonia uncialis* (L.) F.H. Wigg.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. NEW YORK. ROCKLAND COUNTY.: Harriman State Park, between Conklin Mountain and Wanaksink Lake, vicinity of Tuxedo Rock, Sloatsburg Quad. – elev. 900-1200 ft. – Lat. 41° 11' 18"N, Long. 74° 07' 29"W – Dry oak (*Quercus*) forest with open granitic domes interspersed with wet *Sphagnum* depressions. – On granitic outcrop, forming extensive mats.

James C. Lendemer **#11549** 9 March 2008
w/ Vinson Doyle & Christina Mozzicato

308. *Bactrospora myriadea* (Fée) Egea & Torrente

DOMINICAN REPUBLIC. PROVINCE OF LA ALTAGRACIA.: Hispaniola, Parque Nacional del Este, along trail from park entrance to sea. – Lat. 18° 21' N, Long. 68° 37' W – Dry forest. – On *Bursera simaruba*.

William R. Buck **#5108** 30 March 1981

309. *Porpidia tuberculosa* (Sm.) Hertel & Knoph
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. HUNTINGDON COUNTY.: Rothrock State Forest, Colerain Picnic Area, 1 mi NE of village of Spruce Creek, 1.7 mi SW of village of Franklinville, Spruce Creek Township. – elev. ca. 700-800 ft. – Lat. 40° 37' 41"N, Long. 78° 06' 38"W – Hemlock (*Tsuga*) – birch (*Betula*) forest (hemlock dominant) surrounding extensive sandstone talus slope with cold air flow. – On talus.

James C. Lendemer **#11739** 21 April 2008
w/ Bruce Allen, William R. Buck, and Richard C. Harris

310. *Psilolechia lucida* (Ach.) M. Choisy
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. HUNTINGDON COUNTY.: Rothrock State Forest, Colerain Picnic Area, 1 mi NE of village of Spruce Creek, 1.7 mi SW of village of Franklinville, Spruce Creek Township. – elev. ca. 700-800 ft. – Lat. 40° 37' 41"N, Long. 78° 06' 38"W – Hemlock (*Tsuga*) – birch (*Betula*) forest (hemlock dominant) surrounding extensive sandstone talus slope with cold air flow. – On talus.

James C. Lendemer **#11733** 21 April 2008
w/ Bruce Allen, William R. Buck, and Richard C. Harris

311. *Dirinaria frostii* (Tuck.) Hale & Culb.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. NORTH CAROLINA. HAYWOOD COUNTY.: Great Smoky Mountain National Park, vicinity of Baxter Creek, trail to summit of Mt. Sterling (2 miles to summit). – elev. ca. 4500-5800 ft. – Lat. 35° 42' 07"N, Long. 83° 07' 19"W – Spruce-fir-birch forest with sparse hemlock. – On rock overhang.

James C. Lendemer **#11924** 26 April 2008
w/ Kate Deregibus, Kyle Dexter, Suzanne Joneson, Erin Tripp, & Tate Wilson

312. *Rinodina freyi* H. Magn.
Det. R.C. Harris, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. CENTRE COUNTY.: State Game Lands No. 176, Scotia Range, 0.6 mi SSW of shooting range, Ferguson Township. – Lat. 40° 45' 51"N, Long. 77° 56' 15"W – *Populus tremuloides* woods. – On dead lower branches of *Populus tremuloides*.

Richard C. Harris **#54244** 21 April 2008

313. *Cladonia caespiticia* (Pers.) Flörke
Det. J.C. Lendemer, 2007

UNITED STATES OF AMERICA. NEW JERSEY. ATLANTIC COUNTY.: Makepeace Wildlife Management Area, 0 to ½ mi S/SE of Makepeace Lake, ~5.5 mi W of Egg Harbor City, ~2.5 mi E of Weymouth, Egg Harbor City Quad. – elev. 50-60 ft. – Lat. 39° 31' 35"N, Long. 74° 44' 32"W – Upland pine (*Pinus*) – oak (*Quercus*) forests intermixed among extensive red maple (*Acer rubrum*) swamps, Atlantic white cedar (*Chamaecyparis thyoides*) swamps, and abandoned cranberry bogs. – On soil of roadbanks.

James C. Lendemer **#8744** & Andy Moroz 31 March 2007

314. *Biatora vernalis* (L.) Fr.
Det. J.C. Lendemer & R.C. Harris, 2008

UNITED STATES OF AMERICA. VERMONT. ESSEX COUNTY.: Town of Ferdinand, Wenlock Wildlife Management Area, trail to Moose Bog. – elev. 350 m. – Lat. 44° 45' 44"N, Long. 71° 44' 09"W – *Picea mariana* swamp with occasional *Thuja*. – On base of *Thuja*.

William R. Buck **#53727** 18 May 2008

315. *Arthonia byssacea* (Weigel) Almq.
Det. R.C. Harris, 2008

UNITED STATES OF AMERICA. VERMONT. ESSEX COUNTY.: Town of Victory, Victory State Forest, Umpire Mountain. – elev. 550 m. – Lat. 44° 34' 27"N, Long. 71° 50' 57"W – Northern hardwoods and forested cold air, granitic talus slope. – On base of *Acer saccharum*.

Richard C. Harris **#54378** 16 May 2008

316. *Opegrapha varia* Pers.
Det. R.C. Harris, 2008

UNITED STATES OF AMERICA. NEW HAMPSHIRE. COOS COUNTY.: Town of Stewartstown, Hurlbert Swamp Preserve. – elev. 470 m. – Lat. 44° 59' 21"N, Long. 71° 26' 26"W – Mature *Thuja* swamp bordered by *Abies-Picea* swamp. – On sheltered side of slanting *Thuja*.

Richard C. Harris **#54464** 17 May 2008

317. *Caloplaca holocarpa* (Hoffm.) A.E. Wade
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. LACKAWANNA COUNTY.: Lackawanna State Park, S of Lackawanna Lake, Turkey Hill Trail, slopes above PA Route 407, 2.8 mi N of Waverly, North Abington Township. - elev. 1150-1200 ft. - Lat. 41E 33' 18" N, Long. 75E 43' 31" W. - Second growth hardwoods (*Fraxinus, Acer, Fagus* dominant) and ruderal meadows, with occasional boulders and old stone walls. – On *Populus*.

James C. Lendemer **#13250** 17 July 2008

318. *Gyalideopsis moodyae* Lendemer & Lücking
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WYOMING COUNTY.: State Game Lands No. 57, summit of Bartlett Mountain, ~2.4 mi W of Forkston, North Branch Township. - elev. 1900-2100 ft. - Lat. 41° 30' 50" N, Long. 76° 09' 10" W. – Series of sandstone balds (*Picea, Pinus, Tsuga, Acer, Betula* forests) and depression wetlands (*Vaccinium, Nemopanthus*), cool ravines and vertical faces. – On soil along road.

James C. Lendemer **#13884** & John Kunsman 23 July 2008

319. *Cladonia rei* Schaer.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. LACKAWANNA COUNTY.: Moosic Mountain TNC Preserve, Moosic Mountain Barrens, central Moosic Mountains, ~2 mi SE of Jessup, E of Olyphant. - elev. ~2000 ft. - Lat. 41° 26' 28" N, Long. 75° 32' 29" W. - Mosaic of scrub oak (*Quercus*) - pitch pine (*Pinus rigida*) barrens with conglomerate/sandstone bedrock, and open meadows. – On soil.

James C. Lendemer **#12550** 4 July 2008

320. *Cladonia verticillata* (Hoffm.) Schaer.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. LACKAWANNA COUNTY.: Moosic Mountain TNC Preserve, Moosic Mountain Barrens, central Moosic Mountains, ~2 mi SE of Jessup, E of Olyphant. - elev. ~2000 ft. - Lat. 41° 26' 28" N, Long. 75° 32' 29" W. - Mosaic of scrub oak (*Quercus*) - pitch pine (*Pinus rigida*) barrens with conglomerate/sandstone bedrock, and open meadows. – On soil.

James C. Lendemer **#12549** 4 July 2008

321. *Trapelia* sp.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WAYNE COUNTY.: Lacawac Sanctuary, ridge E of lodge, above Wallenpaupack Ledges, Paupack Township. - elev. 1450 ft. - Lat. 41° 23' N, Long. 75° 17' W. - Open ridge with sandstone ledges and sparse oak (*Quercus*) - hemlock (*Tsuga*) - pine (*Pinus*) forest, and adjacent ledges facing small unnamed lake. – On rock.

James C. Lendemer **#12174** 29 June 2008

322. *Halecania pepegospora* (H. Magn.) v.d. Boom
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. LACKAWANNA COUNTY.: Lackawanna State Forest, Phelps Road (loop), 0-0.75 mi S of junction with Sandy Spring Road, NW of Thornhurst, Thornhust Township. - elev. 1600-1700 ft. - Lat. 41° 10' 56" N, Long. 75° 36' 12" W. - Swampy hemlock (*Tsuga*) - mixed hardwood (*Betula, Fagus, Acer*) forest with disturbed roadsides and rock outcrops. – On large boulder in sun.

James C. Lendemer **#13105** 15 July 2008

323. *Bilimbia sabuletorum* (Schreb.) Arnold
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WAYNE COUNTY.: State Game Lands No. 312, along trail between Lehigh Road and West Fork of Lehigh River, E of Lehigh, Sterling Township. - Lat. 41° 15' 30" N, Long. 75° 26' 27" W. - Shaded forest of hemlock (*Tsuga*) - maple (*Acer*) - birch (*Betula*) - beech (*Fagus*), bisected by powerline cut. – On mosses over concrete of spillway dam.

James C. Lendemer **#12267** 30 June 2008

324. *Muellerella lichenicola* (Sommerf. *ex* Fr.) D. Hawksw.
Det. R.C. Harris, 2008

UNITED STATES OF AMERICA. MAINE. WASHINGTON COUNTY.: Town of Beals, Great Wass Island, Great Wass Island Preserve, Mud Hole Trail. - Lat. 44° 28' 52" N, Long. 67° 35' 41" W – Red spruce-balsam fir coastal forest and jack pine bald. – On thallus of *Mycoblastus sanguinarius*, on jack pine.

William R. Buck **#53894** 10 July 2008

325. *Mycoblastus sanguinarius* (L.) Norman
Det. R.C. Harris, 2008

UNITED STATES OF AMERICA. MAINE. WASHINGTON COUNTY.: Town of Beals, Great Wass Island, Great Wass Island Preserve, Mud Hole Trail. - Lat. 44° 28' 52" N, Long. 67° 35' 41" W – Red spruce-balsam fir coastal forest and jack pine bald. – On branches of dead *Pinus banksiana*.

Richard C. Harris **#54790** 10 July 2008

326. *Caloplaca holocarpa* (Hoffm.) A.E. Wade
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WYOMING COUNTY.: State Game Lands No. 57, Sorber Mountain, orange trail, ~1.5 mi S of Stull, E of Noxen, Noxen Township. - Lat. 41° 24' 25" N, Long. 76° 05' 30" W. - Dry oak (*Quercus*) - birch (*Betula*) forest with stands of poplar (*Populus*). – On *Populus*.

James C. Lendemer **#13610** 20 July 2008

327. *Lepraria adhaerens* K. Knudsen, Elix & Lendemer
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WYOMING COUNTY.: State Game Lands No. 57, ~5 mi W of Noxen, just N of Luzerne/Wyoming County Line, Noxen Township. - elev. 1700-1800 ft. - Lat. 41° 22' 55" N, Long. 76° 08' 55" W. - Sandstone ledges with cool moist overhangs, rich hardwood forest (*Acer, Betula, Fraxinus*). – On rock, overhang.

James C. Lendemer **#13475** 19 July 2008

328. *Cresponea chloroconia* (Tuck.) Egea & Torrente
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. WAYNE COUNTY.: Lacawac Sanctuary, ridge E of lodge, above Wallenpaupack Ledges, Paupack Township. - elev. 1450 ft. - Lat. 41° 23' N, Long. 75° 17' W. - Open ridge with sandstone ledges and sparse oak (*Quercus*) - hemlock (*Tsuga*) - pine (*Pinus*) forest, and adjacent ledges facing small unnamed lake. – On *Carya*.

James C. Lendemer **#12647** 6 July 2008

329. *Cladonia pyxidata* (L.) Hoffm.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. NEW YORK. GREENE COUNTY.: Town of Hunter, Catskill Forest Preserve, Stony Clove Notch on W side of NY 214, just N of Devil's Tombstone Campground. – elev. ca. 750 ft. – Lat. 42° 10' 09"N, Long. 74° 12' 00"W – Open talus slope with cold air flows at base and birch (*Betula*) – hemlock (*Tsuga*) forest in areas. – On humus.

James C. Lendemer **#14109** 13 September 2008

330. *Punctelia appalachensis* (W.L. Culb.) Krog
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. NEW YORK. ULSTER COUNTY.: Town of Shandaken, Catskill Forest Preserve, Slide Mountain Wilderness Area, W slope of Slide Mountain, along trail from parking area W of NY 47. – elev. 100-3500 ft. – Lat. 42° 00' 28"N, Long. 74° 25' 13"W – Northern hardwood forest (*Acer, Fagus, Betula*) grading to spruce (*Picea*) and birch (*Betula*) at higher elevations. – On fallen *Acer*.

James C. Lendemer **#13983** 13 September 2008

331. *Lecanora pulicaris* (Pers.) Ach.
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. NEW YORK. ULSTER COUNTY.: Town of Shandaken, Catskill Forest Preserve, Slide Mountain Wilderness Area, W slope of Slide Mountain, along trail from parking area W of NY 47. – elev. 100-3500 ft. – Lat. 42° 00' 28"N, Long. 74° 25' 13"W – Northern hardwood forest (*Acer, Fagus, Betula*) grading to spruce (*Picea*) and birch (*Betula*) at higher elevations. – On fallen *Betula*.

James C. Lendemer **#14010** 13 September 2008

332. *Lecanora austrocailfornica* Lendemer & K. Knudsen
Det. J.C. Lendemer, 2008

ISOTYPE

UNITED STATES OF AMERICA. CALIFORNIA. RIVERSIDE COUNTY.: San Jacinto Mountains, San Bernardino National Forest, Apple Canyon, along Apple Canyon Road, Idyllwild Quad. – elev. 4800 ft. – Lat. 33° 41' 36"N, Long. 116° 39' 28"W – Jeffrey Pines (*Pinus jeffreyi*) along stream. – On *Pinus jeffreyi*.

James C. Lendemer **#15000** & K. Knudsen 31 January 2006

333. *Caloplaca sinapisperma* (Lam. & DC.) Maheu & A. Gillet
Det. R.C. Harris, 2008

CANADA. ONTARIO. BRUCE COUNTY.: Bruce Peninsula National Park, NW of Emmett Lake Road, 2.7 km NE of Hwy 6. – elev. ca. 190 m. – Lat. 45° 11' 52"N, Long. 81° 30' 23"W – Roadside alvar. – Growing over bryophytes in alvar.

William R. Buck #**54239** 21 September 2008

334. *Cladonia stygia* (Fr.) Ruoss
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. PENNSYLVANIA. LACKAWANNA COUNTY.: Bald Mountain, talus slope and summit (W-facing), ~1.5-2 mi NE of Milwaukee, ~5 mi SW of Chinchilla, W of Scranton, Newton Township. - elev. 1800-1900 ft. - Lat. 41° 25' 52" N, Long. 75° 44' 50" W. - Extensive sandstone talus slope and exposed sandstone bluffs of summit, scrub oak and birch forest with ericaceous shrubs. – On talus.

James C. Lendemer **#13381** 18 July 2008

335. *Lecanora allophana* f. *sorediata* Schaer.
Det. J.C. Lendemer, 2008

CANADA. ONTARIO. BRUCE COUNTY.: Bruce Peninsula National Park, just SW of parking area for Halfway Log Dump. – elev. ca. 190 m. – Lat. 45° 13' 38"N, Long. 81° 28' 50"W – *Acer saccharum* dominated forest. – On *Populus*.

James C. Lendemer **#14297** 20 September 2008

336. *Buellia griseovirens* (Turner & Borrer *ex* Sm.) Almb.
Det. J.C. Lendemer, 2008

CANADA. ONTARIO. BRUCE COUNTY.: Bruce Peninsula National Park, Singing Sands, The Dorcas Alvar. – Lat. 45° 11' 24"N, Long. 81° 35' 29"W – Alvar on lake shore, and adjacent mixed conifer (*Picea, Thuja, Pinus*) forest with occasional hardwoods (*Betula, Populus*) and glacial erratics. – On *Populus*.

James C. Lendemer **#14431** 21 September 2008

337. *Xanthoria tenax* L. Lindblom
Det. C.A. Morse, 2007 – Conf. L. Lindblom, 2008

UNITED STATES OF AMERICA. SOUTH DAKOTA. McPHERSON COUNTY.: ca 10 mi W, ½ mi S of Leola, The Nature Conservancy's Ordway Preserve, headquarters. – Lat. 45° 42.89' N, Long. 99° 07.8' W – Rolling mixed grass prairie, glacial erratics, pothole wetlands. – On bark of 3 ft. dbh cottonwood windfall of old shelterbelt.

M.K. Advaita **#5266** 25 April 2007

338. *Cladonia ecmocyna* subsp. *intermedia* (Robbins) Ahti
Det. J.C. Lendemer, 2008

UNITED STATES OF AMERICA. IDAHO. IDAHO COUNTY.: near Burgdorf.

Howard E. Bigelow s.n. 20 July 1954

339. *Scoliciosporum pennsylvanicum* R.C. Harris
Det. R.C. Harris, 2009

ISOTYPE

UNITED STATES OF AMERICA. PENNSYLVANIA. WYOMING COUNTY.: State Game Lands No. 57, Sorber Mountain, orange trail, ~1.5 mi S of Stull, E of Noxen, Noxen Township. – Lat. 41° 42' 25" N, Long. 76° 05' 30" W – Dry oak (*Quercus*) – birch (*Betula*) forest with stands of poplar (*Populus*) – On *Quercus* in deep grooves.

James C. Lendemer **#13611** 20 July 2008

340. *Xanthomendoza weberi* (S. Kondr. & Kärnefelt) L. Lindblom
Conf. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. SOUTH DAKOTA. DAY COUNTY.: ca 1 mi E, 6 mi N of Waubay, Enemy Swim Lake, Nesodak Lutheran Bible Camp. – elev. ca. 1850 ft. – Lat. 45° 26.21' N, Long. 97° 16.83' W – Wooded residential lakeshore with planted deciduous trees and mature native cottonwoods, recent 100mph wind caused many windfalls. – On 2' dbh hackberry (windfall).

M.K. Advaita **#6832** 27 August 2008

341. *Bacidia kekesiana* R.C. Harris
Det. R.C. Harris, 2009

ISOTYPE

UNITED STATES OF AMERICA. VERMONT. ESSEX COUNTY.: Town of Ferdinand, Wenlock Wildlife Management Area, near Moose Bog. – elev. 350 m. – Lat. 44° 45' 44" N, Long. 71° 44' 09" W – Flooded *Thuja* swamp and adjacent spruce-fir. – On *Thuja*.

Richard C. Harris **#54577** 18 May 2008

342. *Cladonia acuminans* R.C. Harris
Det. R.C. Harris, 2009

ISOTYPE

UNITED STATES OF AMERICA. NEW YORK. DUTCHESS COUNTY.: Dover Plains, Roger Perry Memorial Preserve, S of Sand Hill Road, SE of jct with Lime Kiln Road. – Lat. 41° 43' 52" N, Long. 73° 33' 45" W – White calcareous sand and calcareous sandstone outcrops. – Large colony on shaded, grassy slope.

Richard C. Harris **#54800** 4 November 2008

343. *Strangospora moriformis* (Ach.) Stein
Det. C. Morse, 2007; Conf. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. NORTH DAKOTA. OLIVER COUNTY.: ca 2 mi SE of Hensler, The Nature Conservancy's Cross Ranch Preserve. – elev. ca. 1700 ft. – Lat. 47° 14.83' N, Long. 101° 03.22' W – Gentle slopes of mixed grass prairie, Missouri River Valley and floodplain. – On wood of 100-year-old cedar posts.

M.K. Advaita **#5903** 1 June 2007

344. *Phaeographis inusta* (Ach.) Müll. Arg.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. NEW JERSEY. CAPE MAY COUNTY.: Belleplain State Forest, ~1.25 mi W of jct of NJ 550[spur] and Cedar Bridge Rd., S of Cedar Bridge Rd. just E of jct with Tom Field Rd., along Savage Run, Dennis Township. – Lat. 39° 15' 10"N, Long. 74° 52' 10"W – Dense Atlantic white cedar (*Chamaecyparis thyoides*) swamp with sparse maple (*Acer*) bordered by pitch pine (*Pinus rigida*) - oak (*Quercus*) barrens with stands of holly (*Ilex opaca*). – On branches of *Ilex opaca* with *Phaeographis erumpens*.

James C. Lendemer **#15289** 3 February 2009

345. *Parmelinopsis minarum* (Vainio) Elix & Hale
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. NEW JERSEY. OCEAN COUNTY.: Manchester Wildlife Management Area, along N shore of Old Hurricane Brook 0-1 mi W of CR 539 (Hornerstown-Whiting Rd.), ~1.5 mi N of jct of NJ 70 and CR 539 (Hornerstown-Whiting Rd.), Manchester Township. – Lat. 39° 58' 50"N, Long. 74° 24' 30"W – Open pitch pine (*Pinus rigida*) - oak (*Quercus*) forest and Atlantic white cedar (*Chamaecyparis thyoides*) swamp with sparse hardwoods (*Acer*). – On *Quercus*.

James C. Lendemer **#15405** 5 February 2009

346. *Rinodina maculans* Müll. Arg.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. NEW JERSEY. CUMBERLAND COUNTY.: Peaslee Wildlife Management Area, ~1.5 mi N of jct NJ 49 and CR 671(Union Rd.), W of CR 671(Union Rd.), S of powerline cut, 5 mi E of Millville, Vineland Township. – Lat. 39° 23' 30"N, Long. 74° 56' 30"W – Open oak (*Quercus*) - pitch pine (*Pinus rigida*) barrens with sandy openings. – On *Quercus* branches.

James C. Lendemer **#15124** 2 February 2009

347. *Opegrapha longissima* Müll. Arg.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. FLORIDA. DUVAL COUNTY.: Jacksonville Beach, NE corner of intersection of N 20th Street and 2nd Ave. N. – Lat. 30° 17' 24"N, Long. 81° 24' 47"W – Hardwood – palm floodplain forest. – On *Quercus*.

James C. Lendemer **#15904** 9 March 2009

348. *Tylophoron protrudens* Nyl.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. FLORIDA. DUVAL COUNTY.: Jacksonville Beach, NE corner of intersection of N 20th Street and 2nd Ave. N. – Lat. 30° 17' 24"N, Long. 81° 24' 47"W – Hardwood – palm floodplain forest. – On *Quercus*.

James C. Lendemer **#15905** 9 March 2009

349. *Phaeographis lobata* (Eschw.) Müll. Arg.
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. FLORIDA. DUVAL COUNTY.: Atlantic Beach, Tide Views Preserve, along Intracoastal Waterway at W end of 1st St. – Lat. 30° 19' 31"N, Long. 81° 25' 26"W – Hardwood – palm floodplain forest. – On branches of *Baccharis halimifolia*.

William R. Buck **#54563** 9 March 2009

350. *Buellia wheeleri* R.C. Harris
Det. J.C. Lendemer, 2009

UNITED STATES OF AMERICA. FLORIDA. LAKES COUNTY.: Seminole State Forest, along Atula Road from Cassia Trail head S of Brantley Branch Road., 0.1 mi E of SR 44. – Lat. 28° 53' 24"N, Long. 81° 27' 42"W – Live oak – pine forest. – On fallen *Quercus*.

James C. Lendemer **#15848** 8 March 2009

Acknowledgements

William Buck, Richard Harris, Caleb Morse, and Nancy Wilson are thanked for the donation of specimens included in this fascicle.

NEW TAXA (INCL. MYCOBANK NOS.)

1 Note the epithet of this taxon was incorrectly spelled as *"andersonii"* in the article on page 55. This is treated as an othographic error to be corrected. The correct spelling is *"andersoniae"*.